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THESIS

ADAPTING E-MANAGEMENT TO SUPPORT GEOGRAPHICALLY DISPERSED MILITARY TRAINING

by

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December 2008

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ADAPTING E-MANAGEMENT TO SUPPORT GEOGRAPHICALLY DISPERSED MILITARY TRAINING

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This thesis reports on the results to date in supporting managerial decisions concerning training as a part of organizational learning. Training is one of the most important factors in sustaining and expanding the organization's comparative advantage by reinforcing knowledge flow among its members. On the other hand, training is downgraded when it jeopardizes personal incentives like bonus, production goal achievement, and financial accomplishment in the private sector. In a similar way, nearly all military personnel are assigned collateral duties—many of which are very important—but for which many such personnel cannot engage in adequate training to properly accomplish. This research evaluates four web-based decision systems to see how well they can support training among geographically dispersed military units. In particular, because much of the important knowledge associated with training is tacit in nature, how such tacit knowledge can flow effectively and efficiently via the network technologies underlying e-management is important to investigate. The duty of On Scene Leader for shipboard firefighting is chosen as a suitable training focus. The multimedia systems are evaluated via a multi-criteria, multi-expert analysis. Criteria are drawn from the appropriate literature, while NPS officers with appropriate experience serve as experts.

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TABLE OF CONTENTS

LIST OF FIGURES

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LIST OF TABLES

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I. INTRODUCTION

Military services around the world are operating increasingly with great geographical separation between units. Combined with the never ceasing, fast operational tempo of such services (especially given the global war on terror), this creates problems in terms of training. In particular, it has become very difficult to get busy, geographically dispersed personnel to classroom training courses, even though the lack of training impacts their military performance directly.

In the early 1980s Visionary Design Systems, a high technology company located in Silicon Valley, California, introduced new software—the Product Data Management—to store Computer Aided Design (CAD) documents. The introduction of CAD in the early 1970s automated the drawing of items such as car parts, vacuum cleaners and even dolls, where it was extremely difficult to visualize the final product using two-dimensional product drawings. CAD technology rendered the drawings in three dimensions, and the introduced PDM software would help expand those capabilities. But although this product was characterized by senior managers as a very important tool to expand the company's competitive advantage, the effort was jeopardized by a lack of proper knowledge flow (Nonaka, 1994; Nissen, 2006) toward the geographically dispersed sales force. The description of the situation by Bill Braxton, the manager of the PDM department, summarizes the problem:

> It will take four months to train the internal people and get them up to speed on PDM and they aren't going to be profitable during this time. When I sold my own consulting time for five weeks, I brought in good revenue, but I couldn't work on growing the business. I fell behind in my presales work and I couldn't train anyone else. So it's really a problem, if I bring in revenue then I don't have time to invest in the future, but if I don't bring in revenue then I can't get the resources to invest. (ctd in Merchant, Van der Stede, 2007, p. 64)

The above situation describes well one of the numerous dilemmas that managers have to face during distant training. The person who has the tacit knowledge is vital to maintain the appropriate knowledge inventory among the organization, whereas his/her time for training others is in conflict with the organization's objective to maintain its competitive advantage. Some of these problems have been faced through e-learning, as will be described in Chapter II, but the problems persist and in some cases have enormous effects.

As a more serious example, the lack of training and cultural knowledge associated with the Abu Ghraib prison events caused severe problems in American diplomacy. Abu Ghraib is 20 miles from Baghdad and, during Saddam Hussein's administration, was a death house where beating and torture were commonplace. After U.S. troops seized control of the prison, the U.S. government sent two former directors of the Utah Department of Corrections to re-establish the penal system in Iraq. Abu Ghraib was remodeled and set in full operation, staffed by members of the Army's 372^{nd} Military Police Company in the role of detention officers. These members, without proper training in either corrections or Muslim culture, engaged in jailhouse humiliations, taking pictures to document their actions. This story broke in 2004, strongly affecting the efforts of the U.S. government to establish the peace in Iraq (Abu Ghraib's back story, 2008).

These are just two examples of the various problems that a manager has to face when he/she tries to organize the proper training for the people who need it. This effort, aggravated by the distance between trainee and trainer and the complexity of knowledge flow, creates an inhibitor to effective training.

Furthermore, even if various training techniques such as e-learning or computer based training could be used, the flow of tacit knowledge remains ambiguous and demands a great effort at the managerial level to support this transition. "The problem is, knowledge is not evenly distributed through the enterprise, and large, geographically-dispersed, time-critical enterprises such as the Navy are particularly prone to knowledge "clumping". (…) When an enterprise depends on its organizations and people being where they are needed, when they are needed, and knowing what to do when they get there, the uneven distribution of knowledge can be crippling to the enterprise without effective systems and processes to enable knowledge to flow freely." (Nissen, 2001, p. 1-2).

On the other hand, and despite the fact that the organizations realize the importance of the externalization (Nonaka, 1994) of the possessed knowledge inventory, it appears that in a lot of cases this knowledge is clumped. A clumping occurs either unintentionally or intentionally when it jeopardizes personal incentives like bonus, production goal achievement, and financial accomplishment in the private sector. In a similar way, nearly all military personnel are assigned collateral duties—many of which are very important—but many such personnel cannot engage in adequate training required to accomplish their duties well. For example, the On Scene Leader (OSL) is responsible for the critical task of shipboard fire fighting—a collateral duty—for which he or she cannot be trained well while at sea.

Many people today look to e-management for help with geographically distributed training. E-management is the process of using intelligent decision tools in an Internet-based multimedia environment in order to bridge the gap between cognitive and analytic problem solving concerning the clumping in knowledge flow. However, e-management as it is understood today does not inform training programs' decisions makers adequately to address these problems effectively. In particular, because much of the important knowledge associated with training is tacit in nature, it remains unclear how such tacit knowledge can flow effectively via the network technologies underlying e-management. This leads to the central research question: how can e-management contribute toward effective, geographically dispersed training where tacit knowledge is required to flow?

The purpose of this research is to examine how web-based Decision Support Systems can support the flow of tacit knowledge, through training, among geographically dispersed organizations. Recent studies have shown the effectiveness and efficiency of cross-border knowledge transfer (Perez-Nordtvedt et al., 2008). Such a transfer is highly affected by interpersonal relationship, institutional and organizational ties (Bell & Zaheer, 2007) but mainly refers to the flow of explicit knowledge.

The organizations in this knowledge based environment struggle to acquire the necessary competitive advantage by focusing their attention on those knowledge assets that they possess. Consequently, it appears that the organizations are distributed learning systems:

> Firms are (…) distributed knowledge systems in a strong sense: they are decentered systems, lacking an overseeing ‘mind’. The knowledge they need to draw upon is inherently indeterminate and continually emerging; it is not self-contained. (Tsoukas, 1996, abstract)

This thesis explores ways to support the managerial decisions concerning ways of eliminating potential incidents of clumping among organizations cells, especially when these cells are geographically dispersed. The research has been limited to the flow of knowledge of a specific duty, in this case the On Scene Leader (OSL) who handles fire fighting onboard naval ships, where tacit knowledge flow is required.

The first part of this study (Chapter II) is a bibliography review of Knowledge Management and the basic principles of its creation and flow. This review, enriched with theories of Organizational Learning, description of e-management decision tools and finally a description and layout of pros and cons of the present training methods, provides the lenses needed to proceed to the second part of the research. The next part is the presentation of five Interactive web-based Multimedia Systems (Adobe Director 11, Meta-Card, Super-Card, i-Think V9, and Powersim System 7) and evaluation of the four that offer potential for e-management training. The OSL for shipboard firefighting is chosen as a suitable training focus. The multimedia systems are evaluated via a multi-criteria, multi-expert analysis. Criteria are drawn from the appropriate literature, while NPS officers with appropriate experience serve as experts.

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II. BACKGROUND

Following the Introductory chapter where we define our research question and the boundaries of this thesis, this chapter presents the cornerstones of our research. We first look of at the concept of knowledge management and how knowledge differentiates from data and information. We then identify the two types of knowledge (i.e., tacit and explicit) and how knowledge is created and flows. The discussion about knowledge management concludes with the reasons that produce the knowledge's clumping. The second part of this chapter presents current training methods and techniques, and we outline the pros and cons of each method. The chapter continues presenting the basic principles of e-management and how we design web-based decision support systems. The chapter concludes with the presentation of how the On Scene Leader (OSL) handles firefighting on board naval ships and includes the training requirement to enhance his/her performance.

A. KNOWLEDGE MANAGEMENT

In the long tradition of academic epistemology, knowledge has been defined as "justified true belief" (Nonaka, 1994; Nonaka & Toyama, 2005; Gourlay, 2006; Wallace, 2007). This definition gives us the perception that knowledge is something objective, changeable over time as beliefs change, and certified to be true. Therefore, knowledge today might not be knowledge tomorrow. Consequently, in a never ceasing, high tempo global environment the management of organizational knowledge becomes crucial (Argyris & Schön, 1978). Moreover, it is now widely accepted that each organization's competitive advantage flows from its unique knowledge inventory (Spender, 1996; Liebowitz, 2000). The practice of Knowledge Management (KM), which gained prominence during the 1990s, is described by Danny P. Wallace (2007, p. 1) as: "…an innovative approach to redirecting the energies and activities of organizations by enhancing the generation, flow, and use of internal knowledge." This section presents some of the main aspects of the knowledge management theories.

1. Distinction Between Data, Information and Knowledge

There are two theories about the hierarchy between data, information and knowledge. These theories try to depict the sequence of what is created from what, although this effort reminds us of the **chicken or the egg** causality dilemma. The first theory conceptualizes the hierarchy of data, information and knowledge as shown in Figure 1. Each level builds upon the last, with data occupying the lowest level of the hierarchy. The following Gedanken experiment (Nissen, 2006) is useful in order to follow this taxonomy. Someone tries to learn a new language—for example, Greek. Naively, his first stop is a Greek dictionary. The first word that meets his eyes is the word ακολουθια (akoloothia). It is certain that this five syllabus word means nothing to him. It will even take him some time to try to pronounce the "t" simultaneously with "h" to reproduce the Greek letter "thita." But above this, the word has no meaning other than a simple group of letters. These are actually data which have no power to support actions (learn Greek).

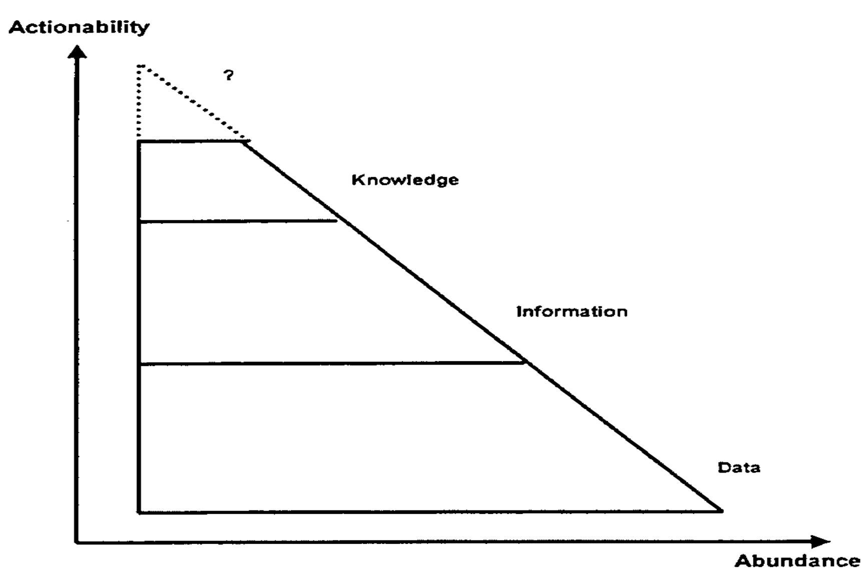


Figure 1. Knowledge Hierarchy (After Nissen, 2001)

After this shocking experience with the new language, the student tries to proceed a little more and reads the definition of this new word. He figures out that ακολουθια means escort, while the NTC'S New College Greek and English Dictionary gives another definition of the word as "(eccl.) service, mass." Therefore, those definitions help the student to make sense of the initial data. The Greek word ακολουθια (akoloothia) means escort or service, mass. Is it knowledge yet? Depicted from the triangular shape of this hierarchy, knowledge is somehow better or more than data and information. The knowledge is what will help us to take action (Nissen, 2006). Knowing just a simple definition is not knowledge. It is information which, combined with other information, will lead us toward fluency in Greek.

Therefore, knowledge is the higher level of the hierarchy of Data-Information-Knowledge, allowing us to take actions based on the acquired data and information. Although this is one of the major characteristics of knowledge (taking actions), it is very difficult to define what knowledge is. This thesis uses the definition given from Davenport and Prusak (as cited in Wallace, 2007, p. 15):

> Knowledge is a fluid mix of framed experience, values, contextual information, expert insight and grounded intuition that provides an environment and framework for evaluating and incorporating new experiences and information. It originates and is applied in the minds of knowers. In organizations it often becomes embedded not only in documents and repositories but also in organizational routines, processes, practices and norms.

Although the definition facilitates the hierarchy of Data-Information-Knowledge (describing knowledge as a fluid mix of framed experience, values, contextual information), it pushes the definition a little further by saying that knowledge incorporates new experience and information. And this is probably the base of the second theory about the hierarchy between Data-Information-Knowledge where this hierarchy needs to be reconsidered as Knowledge-Information-Data (Tuomi, 2000).

According to this theory, data emerges last, only after knowledge and information are available. This reversed hierarchy is depicted in Figure 2.

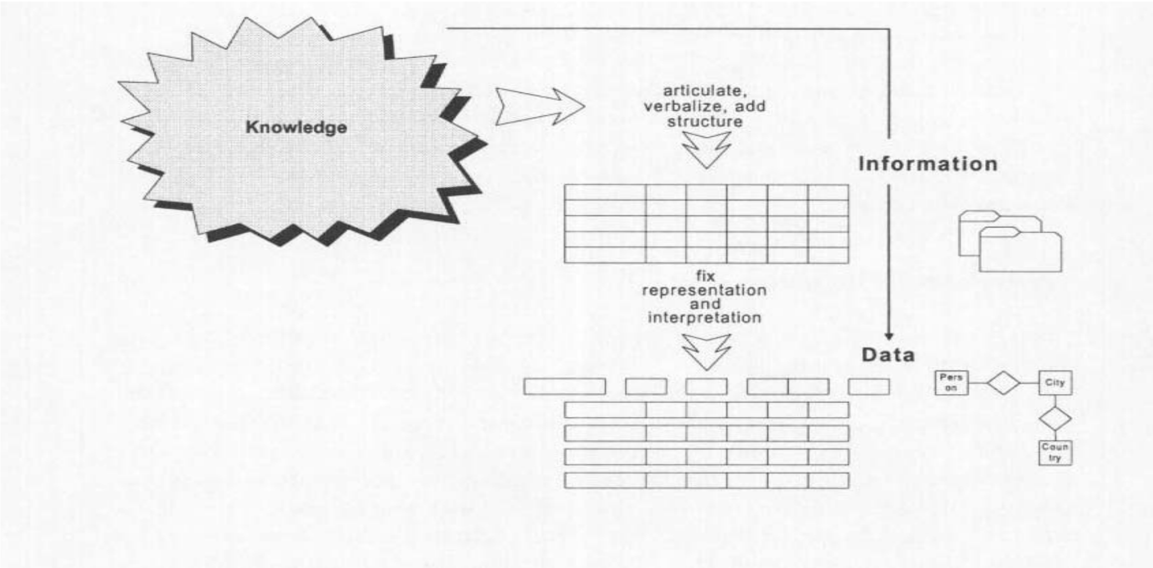


Figure 2. The Reversed Hierarchy (After Tuomi, 2000)

Knowledge is actually used to decipher individual chunks of knowledge and convert them into focal and structured means of communications. Those means of communication are conventionally called information. When such articulated knowledge is stored by electronic means such as a computer, the meaning of each piece of information must be presented. Therefore, information is splintered into small cells which are called data. It is like creating a data base in Windows Access ® software. The author of this work must have knowledge to work with this software. Using this knowledge can create the desired data base, where there is a lot of information embedded (e.g., the definition of each table used). Finally, this embedded information must be presented to the user, something that is done by creating forms, questions or reports, which at this point are the data.

2. Types of Knowledge

Polanyi classified human knowledge into two categories; explicit and tacit (as cited in Nonaka, 1994; Tsoukas, 1996). “Explicit” knowledge is that which can be deciphered in a way that can be transmitted in formal, systematic language (Nonaka, 1994; Tsoukas 1996); on the other hand, “tacit” knowledge is difficult to formalize, as it is implicit within the knower (Nonaka, 1994; Nissen, 2006). The previous paragraph uses the definition for knowledge from Davenport and Prusak, where knowledge is considered as a fluid mix of framed experience, values, contextual information, expert insight and grounded intuition. This mixture actually gives the distinction between the two types of knowledge: “explicit,” which in our definition arises from “values, contextual information” and “tacit,” which comes from “experts‘ insight and intuition.”

Spender (as cited in Tsoukas, 1996), on the other hand, identifies four types knowledge which the organization makes use of. For him, knowledge can be held either from the individuals or the organization itself on a collective level. Moreover, the “…knowledge can be articulated explicitly or manifested implicitly—namely, it is, respectively, more or less abstracted from practice. Thus, there are four types of organizational knowledge:

i. Conscious : explicit knowledge held by individuals
ii. Objectified : explicit knowledge held by organization
iii. Automatic: preconscious individual knowledge
iv. Collective: highly context-dependent knowledge which is manifested in the practice of an organization” (Tsoukas, 1996, p. 14)

Explicit knowledge is sometimes confused with information because both come in a formal way (e.g., through writing, or drawing); actually, knowledge, either explicit or tacit, enables action by itself. Nissen (2006) gives an example of the difference between explicit knowledge and information, using a recipe in a cookbook. The recipe in question consists of two parts; the first part contains the list of ingredients needed and the second part contains the preparations. The first part informs the potential cooker about the description, quantity and quality of the necessary ingredients needed for every dish. Therefore, it can be considered as information, as it ascribes meaning to the context of the initial data (e.g., units of measure, food description). On the contrary, the second part describes the procedure for preparing the meal. It contains actions (cooking); therefore, it is knowledge and, more precisely, explicit knowledge.

Although there are a lot of cookbooks, not everyone can prepare a delicious meal. Thus, though the described procedure of preparing the meal can be done by any of this recipe's readers, the quality of the final product is not always the same. This is a case of tacit knowledge. Such cognitive knowledge, with a personal quality, is hard to formalize and transmit (Polanyi, 1966; Nonaka, 1994). It is what Polanyi (1996, p. 4) speaks of when saying that "We can know more than we can tell." A chef knows more than he can put on a simple paper as a recipe.

3. Methods of Knowledge Creation and Flow

One of the most-known theories of knowledge creation grows out of the work of Nonaka (1994). Based on the assumption that knowledge is created through conversion between tacit and explicit forms, Nonaka describes four modes of knowledge conversion, as shown in Figure 3.

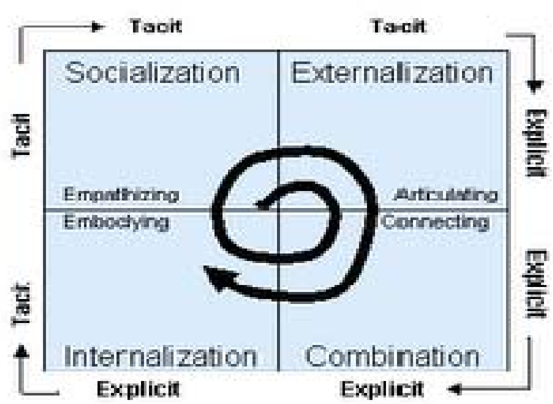


Figure 3. The SECI Model (After Nonaka and Takeuchi, 1995)

The first mode of knowledge conversion is “socialization.” As Nonaka (1994, p. 19) describes: “Apprentices work with their mentors and learn craftsmanship not through language but by observation, imitation, and practice.” The word “mentor” can be tracked back to Greek mythology where Odysseus, the king of Ithaca and hero of Homer’s poems the Iliad and Odyssey, left his son in the care of Mentor, a person who was responsible to teach and guide the boy during his father’s absence. Therefore, mentoring has always been considered a major component of knowledge transfer, and is gaining importance in recent literature for organizational learning (Swap, et al. 2001).

Besides mentoring, other forms of socialization can play a vital role in knowledge conversion. As described in the previous paragraph, mentoring is a procedure where a person with a deep knowledge base assumes the role of teacher for an apprentice, providing him with the knowledge of how to do something (e.g., critical skills and managerial systems) but also the values and norms that are important for using the acquired knowledge assets (Swap, et al. 2001). On the other hand, storytelling can be used to communicate chunks of knowledge. Take, for example, a fatal accident which happened while two employees were spreading cement as it was being deposited by one cement mixer truck, as described in the Portal of the U.S. Department of Labor.

> One employee was moving the hose (elephant trunk) to pour the concrete when the boom of the pumper truck came in contact with the overhead rover line carrying 7,620 volts. Employee received a fatal electric shock and fell on the other employee who was assisting him. The second employee received massive electrical shock and burns. (From OSHA, 2007)

This story, if disseminated to construction companies, would get employees thinking more responsibly about overhead high voltage cables, long before the assessment of the accident would .result in lessons learned embodied in the formal training.

The next mode of knowledge conversion is *Externalization*, which provides the means to develop the concepts of embedded tacit knowledge, allowing it to flow more quickly. It pertains to how tacit knowledge becomes explicit and provides the context for the next mode of knowledge conversion. This next mode is *Combination* which facilitates the conversion from Explicit Knowledge, which as described in the previous paragraphs is brought out into the open and can be formalized. “The reconfiguring of existing information through the sorting, adding, re-categorizing, and re-contextualizing of explicit knowledge can lead to new knowledge” (Nonaka, 1994, p. 19). This method is much more powerful due to the evolution of Information Technology. The reconfiguration of the explicit knowledge is easier with the extensive use of the Internet; therefore, new concepts/knowledge can be created through networking of codified information and knowledge (Nonaka & Takeuchi, 1995).

Likewise, *Combination* provides the context for *Internalization* which distinctively describes the mutual influence between Explicit and Tacit Knowledge. *Internalization* describes the transformation of Explicit-to-Tacit Knowledge, and has partial analogs in the theory of Organizational Learning (Nonaka, 1994), whereas Externalization can possibly find analogs among the theories of the Learning Organization

Following the theory of knowledge conversion and the discussion of the epistemological dimension of organizational knowledge creation (Nonaka & Takeuchi, 1995), the theory of Organizational Knowledge Creation also describes the ontological dimension of this procedure. The four stages of knowledge conversion are not sufficient by themselves to create knowledge. The basis of this creation is the tacit knowledge of individuals (Nonaka & Takeuchi, 1995). The organization has to set this knowledge into motion—to mobilize it. This mobilization is depicted in Figure 4, where “the mobilized tacit knowledge is “organizationally” amplified through four modes of knowledge conversion and crystallized at higher ontological levels” (Nonaka & Takeuchi, 1995, p. 72), something which is called “knowledge spiral.”

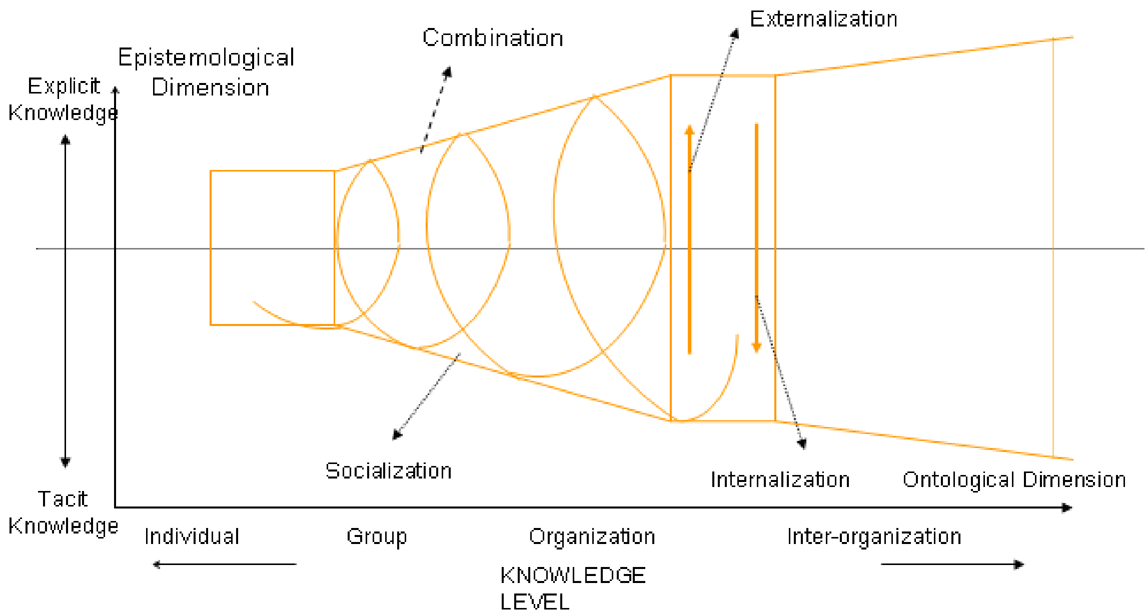


Figure 4. Spiral of Organizational Knowledge Creation (After Nonaka and Takeuchi, 1995)

Although the theory of Nonaka and his colleagues has achieved paradigmatic status throughout the academic and workplace community (Gourlay, 2006), there is also opposition. As Gourlay (2006, p. 1430) comments:

> The underlying theory rests on a unidimensional view of tacit knowledge, ignoring views that tacit knowledge may be at least partially if not wholly inherently tacit. The distinction between explicit knowledge and knowledge seems unclear, until on examination it is evident that Nonaka and his colleagues have redefined knowledge to mean "justified belief". This is more than simply a contraction of the traditional (western) epistemological definition of knowledge, since it refers specifically to managers' beliefs, justified with respect to prior strategic decisions and to forecast.

The base of his argument is the empirical examples that Nonaka and Takeuchi use to describe the conversion between tacit and explicit knowledge. Although the bread-machine study successfully presents evidence of socialization and externalization, the other examples (Kraft General Foods and

Honda city project) are open to alternative explanations where knowledge conversion can be conflated with knowledge transfer. Subsequent research by Nissen (2002) extends Nonaka's spiral and two-dimensional model of knowledge conversion to a four-dimensional model where more of the argument from Gourlay can be covered efficiently. As depicted in Figure 5, this model integrates two more dimensions: *life cycle* and *flow time*; it also uses the terms "*Explicitness*" and "*Reach"* instead of "*Epistemological"* and "*Ontological dimension"* that were used by Nonaka and Takeuchi (1995, p. 59).

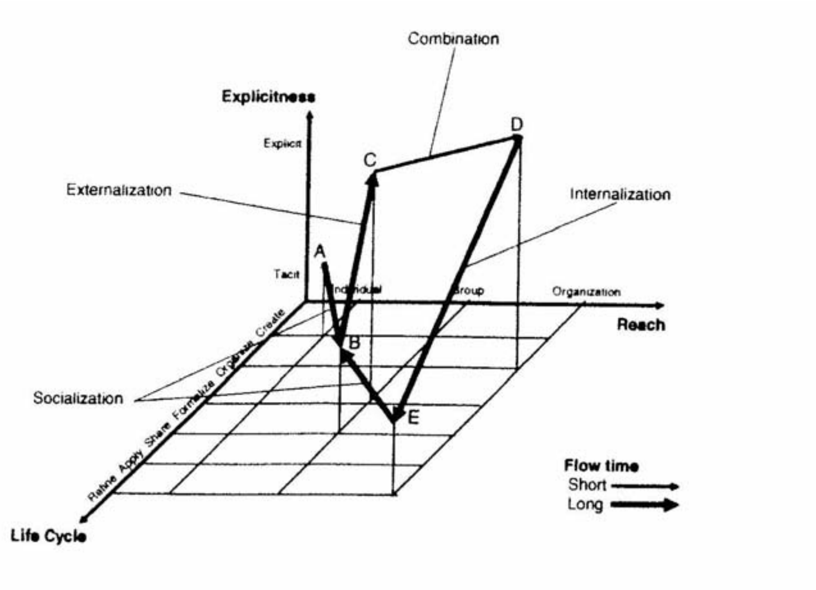


Figure 5. Multidimensional knowledge-flow visualization (After Nissen, 2006)

> The figure illustrates how our four dimensions can be combined to visualize a representative knowledge flow from this [Nonaka's] well-known theory. The explicitness dimension is shown as the vertical axis with tacit and explicit endpoints. The reach dimension identifies different levels of social interactions (e.g., individual, group) on the horizontal axis. The life cycle dimension is plotted as a third axis labeled with six KM activities (e.g., create share apple). (Nissen, 2006, p. 35).

For example, the vector AB expresses the transformation from Individual Tacit Creation of Knowledge to Group Tacit Share of Knowledge, something that takes place through Socialization but which needs long flow time, expressed by the thick arrow. This approach actually bridges the gap between Gourlay and Nonaka, satisfying Gourlay's argument about Nonaka's theory that knowledge conversion can be conflated with knowledge transfer.

4. Knowledge Clumping

Throughout the knowledge conversion and flow process (as depicted in Figure 5), there is always the possibility of what is described as knowledge clumping. The clumping usually takes place in the minds of individuals (Nissen, 2006) where chunks of tacit knowledge remain stagnant, whereas the leader or manager wishes this knowledge to flow quickly and efficiently across the members of the organization. Numerous reasons can be described that cause this clumping, sourcing from various sciences (sociology, psychology, information technology, knowledge management). This thesis focuses on the following two reasons that cause clumping among geographically dispersed units.

The first reason is the degree of appropriability of tacit and codified (explicit) knowledge. According to the Oxford English Dictionary, appropriability is the ability to take possession of something. Knowledge is not always obtainable. Explicit knowledge, by definition, is usually in an easier form to transmit. But when dealing with tacit knowledge, the degree of appropriability is very large. The fact is that the knowledge held by an organization is not the sum of its members' knowledge (Saviotti, 1998). Big chunks of knowledge remain individual property, with limited codification and therefore limited transition. "The cumulative character of knowledge implies path-dependence and the creation of barriers, as established participants in given technologies, accumulate a differential advantage with respect to potential entrants" (Saviotti, 1998, p. 845).

Knowledge held by an organization is not totally tacit or explicit. Even with the best codification, it remains partially tacit in the mind of the one who created it (Saviotti, 1998). Moreover, the acquisition of the knowledge, even if it totally codified, is not free. The agent who wants to acquire a piece of knowledge must learn the “code” of this knowledge, which is only free for those who created it. The value to obtain the code and therefore the way to obtain the knowledge can be measured either in monetary terms (number of dollars), or with non material values (e.g., use of free time, use of working day time when the employee could participate in the organization manufacturing process).

Saviotti (1998, p. 850) provides a formula which tries to describe the correlation between the degree of appropriability and the degree of codification. According to this formula:

i. It is easier to imitate an older technology than a totally new one.
ii. The more knowledge codified, the more easily it is obtained.
iii. The increase of numbers of agents knowing the code will decrease the Degree of Appropriability.
iv. In order for an organization to acquire a competitive advantage, an agent should push the knowledge frontier as fast as possible, increasing appropriability.

The second reason for knowledge clumping is geography. The geographic effect is gaining more and more importance in the latest literature, as the difficulty of transmitting knowledge between members of organizations increases with geographic distance while decreasing with geographic proximity (Bell and Zaheer, 2007). Furthermore, the difficulty of knowledge flow increases when talking about tacit knowledge (Bell & Zaheer, 2007); this implies the lack of a high degree of codification, and thus a relatively slower flow and probably a high level of clumping. The inhibitors that contribute to the relatively low flow of tacit knowledge between geographically dispersed organizations are as follows:

i. The nature of tacit knowledge makes it more contextual (Perez-Nordtvedt et al., 2008) and uncertain, and therefore more rigid to transmit. This difficulty might require formal meetings and conferences which are facilitated from geographic proximity (Bell & Zaheer, 2007).

ii. The geographic distance reduces the possibilities for face-to-face interactions (Bell & Zaheer, 2007), mentoring (Noe, 1988; Swap, et al., 2001) and storytelling (Swap, et al., 2001).

iii. The flow of knowledge among geographically dispersed organizations is highly affected from the available network infrastructure. A abundance of networks can bridge the gap that creates the geography.

B. PRESENT TRAINING METHODS.

Reiterating briefly the model form Nissen (2006) about the Multidimensional knowledge-flow visualization, it can be seen that the transformation and flow of knowledge can take various forms and paths. One of the most important routes of this transformation is called Organizational Learning. Argyris and Schön describe that "organizational learning occurs when members of the organization act as learning agents for the organization, responding to changes in the internal and external environments of the organization by detecting and correcting errors in organizational theory-in-use, and embedding the results of their inquiry in private images and shared maps of organization" (1978, p. 29). The following paragraphs show some forms of organizational learning.

1. In-Class Training

In-class training is the traditional method of performing training either in military or in private sector. In this case, the instructor and the students are gathered in a classroom or other available room for a specific period of time. The instructor is responsible to apply all the available instructional means (e.g., PowerPoint slides, notes, books, models) to assist the process. Although the technology based training (e-learning, Computer-Based Training) continues to gain ground as the preferred training method among companies (Anders, 2007), the traditional method of face-to-face training will remain one of the major methods of training (Gordstein & Ford, 2002). As Anders (2007) describes, the companies find that online training has its limits and major companies like Home Depot will continue using the in-class method.

One of the major advantages of the classroom-based and instructor-led training is that it takes place in a specified time table, inside a class where the participant is totally freed from any other form of obligation (Goldstein & Ford, 2002). On the other hand: “many students who have undergone only classroom training find it difficult to adjust to the demands of a working environment after leaving the classroom” (Connor, 1983, p. 5). Furthermore, in-class training is sometimes very expensive for geographically dispersed organizations, where either the employee must be flown to the central training facility or the trainer must travel in order to provide the specified training.

Last, but certainly not least, is the fact that trainers need to be trained themselves (Wampler, et al. 2006). The trainers must learn how to execute and facilitate newly developed training procedures and to understand the circumstances in which each method can be used.

2. On-the-Job Training

On-the-Job Training (OJT), otherwise known as “learning through experience” (Connor, 1983, p. 1), is widely used as a method of training, not only in minor subjects but also for highly sensitive professions (e.g., on board a naval ship). Experience has shown this author that OJT is one of the major ways of doing training onboard ship, and takes into consideration the highly intense operational tempo of a naval vessel. The term OJT involves mentoring as well but in this section we are discussing the form of OJT that leaves people to learn simply by trial and error.

Each trainee has his/her own unique tempo of learning. Trainee-centered OJT can be modified to account for this, as it is does not rely on the strict timetable that characterizes a more formal training method like in-class training (Connor, 1983). Furthermore, the training takes place in the actual working environment, which makes it more real and useful for the trainee (Connor, 1983). Finally, the mentoring between the trainer and the trainee can enhance the learning process.

On the other hand, trainees within OJT will only perform the tasks themselves after the completion of each stage of training. This is in stark contrast to simulator training. For example, a new pilot trained under OJT will land the aircraft for the first time by himself only after completion of the training, without any chance of failure. Meanwhile, a pilot training in a simulator enjoys the opportunity for trial-and-error through numerous landings, without casualties, before actually performing his/her first actual landing.

3. Technology-Based Training

With the advent of Information Technology, technology-based training (TBT) (e.g., e-learning, Computer-Based Training, Web-Based Training) became a part of organizational learning, and in recent years has seemed to be treated like the panacea of all training problems. But although TBT is gaining ground against the traditional forms of training (e.g., in-class training), tradition still rules in areas where mentoring and customer interactions are necessary. According to George Anders (2007, p. B3):

> Traci Sitzmann, a research scientist working for the U.S. Defense Department's Advanced Distance Learning Co-Laboratory, reviewed 96 training studies conducted since 1996, and found that web-based training was more effective than classroom instruction for teaching facts. But she didn't find significant differences between the two for teaching overall job mastery.

On the other hand, although e-learning is not the panacea it may appear to be (Anders, 2007), the pros of this newly established training method are many. First, students have access to learning material all over the world without the obligation to bring it into one class. Second, the training takes place at a time convenient to the student and a frequency that helps him to absorb the material

(Bobinski, 2004). Furthermore, with technology-based training the trainer has the ability to review and amend the materials more easily (Kearsley, 1983).

However, although Information Technology (IT) is capable of supporting technology-based learning, it sometimes fails to produce the expected results. “Over-reliance on IT has sounded the death knell for myriad KM projects” (Nissen, 2006, p. 49). Reiterating briefly, knowledge is build upon data and information. IT can successfully transmit those data and information or, even more, explicit knowledge, but the actual conversion of those signals into tacit knowledge takes place into the minds of individuals (Nissen, 2006). Therefore, although geography as an inhibitor to knowledge flow can be limited with IT, the IT itself does not support the flow of tacit knowledge well. (Nissen, 2006).

C. E-MANAGEMENT

There is little information available about the term e-management. Although terms like e-business (“the activity within electronic markets” (Beynon-Davies, 2004, p. 2)) and e-government (“… the use of information technology (..) to deliver public services” (Holmes, 2001, p. 2)) have been extensively analyzed and used, the term e-management has not garnered the same attention in the academic literature. E-management is the practice of using intelligent decision tools in an Internet-based multimedia environment in order to bridge the gap between cognitive and analytic problem solving (Beroggi, 2005).

> Problems occur and must be solved in the real-world environment. Because of the environment’s complexity, and also because of the problem solver’s subjective perception of the environment, models, abstractions of the system under investigation, are developed to analyze data, to simulate the system’s behavior and to investigate decision options” (Beroggi, 2001, p. 341).

But it appears that different people use those kind of decision tools in completely different ways. Consider, for instance, the respective view points of a user of a file drawer system and of a user of a very large optimization model. Whereas the file drawer user might conclude that the essence of decision support lies in on-line access to data, the optimization user might feel that the on-line access is completely beside the point since each run of his DSS (Decision Support Systems) might require two hours of preparation and setup. (Alter, 1980, p. 92)

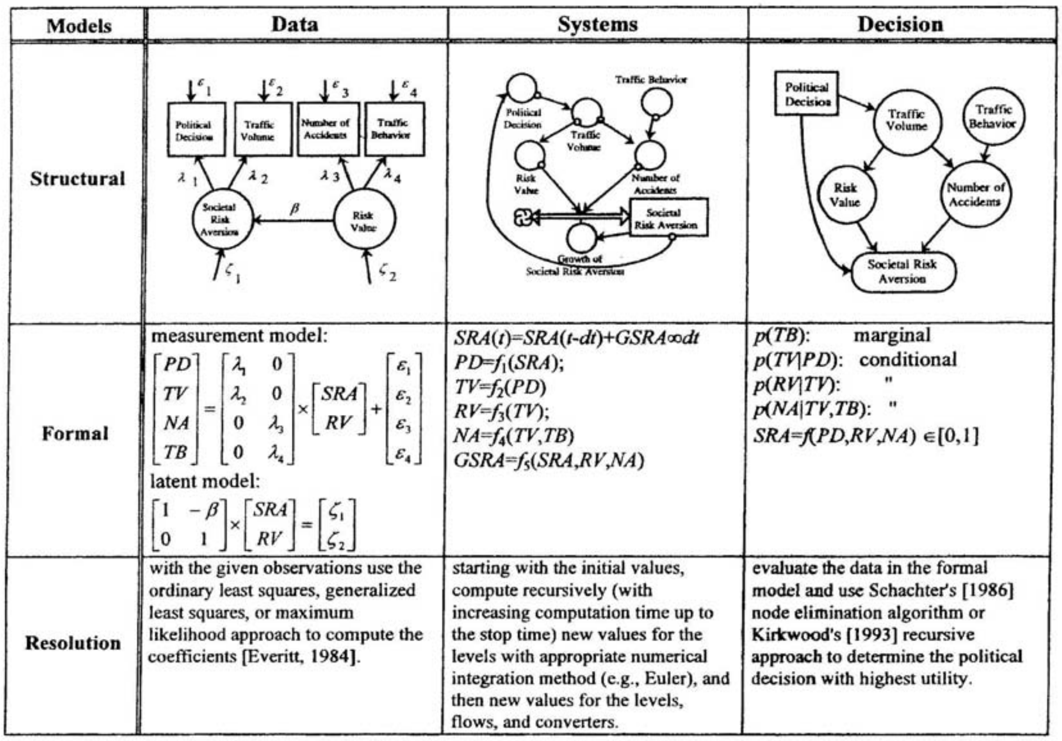
Therefore, the e-management tools like web-based decision models try to bridge the gap between the mental and cognitive phases of modeling construction and the analytical one (Beroggi, 2001, 2004), taking into consideration the importance of the interactive use of Decision Support Systems (Alter, 1980).

The design of e-management decision tools matures along the three lines of a visual modeling environment, described by Beroggi and Aebi (as cited in Beroggi, 2001, p. 339). These three lines are:

i. The analysis of the observations (data analysis)
ii. The analysis of the system's performance (systems analysis)
iii. The analysis of the decision option (decision analysis)

The first line reflects the agreement between the manager and the tool builder that there is a sub-problem that must be confronted with a non-traditional procedure (Sprague Jr., 1986). The second line is the analysis of the system's performance to detect deviations relevant to the desired "normal" state of the system (Beroggi, 2001). If a deviation exists, then in the third phase of the decision analysis there is an identification and evaluation of alternatives, statements of preference, and aggregation; a proposal is the final product of this process. This *choice*, as it is called by Herbert Simon (as cited in Sprague Jr., 1986) is applied and after a few weeks the system is evaluated again to detect any chunks of improvement or pitfalls, modified and expanded (Sprague Jr., 1986).

This analytical modeling process can be depicted by models to analyze the data, simulate the system's performance and propose solutions in a given troubled situation. The three-step breakdown of this process is shown in Figure 6 and contains the Structural, Formal, and Resolution Phases. The Structural Phase is actually the elements of the systems; the links between those elements and causal links that affect them are depicted in diagram form (Beroggi, 2001). The Formal Phase is the process of depicting the formulas and the mathematical relations between each of the above elements and the causal links that affect them. Finally, the Resolution model is the result of this process, which offers the possibility of simulating the real system, enforcing the alternatives and seeking solutions to the designated problems.



Models	Data	Systems	Decision
Structural	Political Decision, Traffic Volume, Number of Accidents, Traffic Behavior; ε_1, ε_2, ε_3, ε_4; λ_1, λ_2, λ_3, λ_4; Societal Risk Aversion, Risk Value, β; ζ_1, ζ_2	Traffic Behavior, Political Decision, Traffic Volume, Risk Value, Number of Accidents, Societal Risk Aversion, Growth of Societal Risk Aversion	Political Decision, Traffic Volume, Traffic Behavior, Risk Value, Number of Accidents, Societal Risk Aversion
Formal	measurement model: $\begin{bmatrix} PD \\ TV \\ NA \\ TB \end{bmatrix} = \begin{bmatrix} \lambda_1 & 0 \\ \lambda_2 & 0 \\ 0 & \lambda_3 \\ 0 & \lambda_4 \end{bmatrix} \times \begin{bmatrix} SRA \\ RV \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \\ \varepsilon_3 \\ \varepsilon_4 \end{bmatrix}$ latent model: $\begin{bmatrix} 1 & -\beta \\ 0 & 1 \end{bmatrix} \times \begin{bmatrix} SRA \\ RV \end{bmatrix} = \begin{bmatrix} \zeta_1 \\ \zeta_2 \end{bmatrix}$	$SRA(t)=SRA(t-dt)+GSRA\infty dt$ $PD=f_1(SRA)$; $TV=f_2(PD)$ $RV=f_3(TV)$; $NA=f_4(TV,TB)$ $GSRA=f_5(SRA,RV,NA)$	$p(TB)$: marginal $p(TV\|PD)$: conditional $p(RV\|TV)$: " $p(NA\|TV,TB)$: " $SRA=f(PD,RV,NA) \in [0,1]$
Resolution	with the given observations use the ordinary least squares, generalized least squares, or maximum likelihood approach to compute the coefficients [Everitt, 1984].	starting with the initial values, compute recursively (with increasing computation time up to the stop time) new values for the levels with appropriate numerical integration method (e.g., Euler), and then new values for the levels, flows, and converters.	evaluate the data in the formal model and use Schachter's [1986] node elimination algorithm or Kirkwood's [1993] recursive approach to determine the political decision with highest utility.

Figure 6. Three-step decomposition of the analytic modeling process (After Beroggi, 2001)

The traditional modeling structure is aimed at one of the above three processes: Structural, Formal or Resolution. But this distinction does not allow the developers to understand the complexity of the decision making where the decisions "…focus on the identification and evaluation of alternatives for multiple criteria, different decision makers and selected scenarios" (Beroggi, 2001, p. 344). In a Web-based environment, there is the possibility of interacting with users to answer numerous questions and bridge the gap between the analytic processes of decision making, and the cognitive process.

D. ON-SCENE LEADER DUTY

This thesis is limited to the knowledge flow of a specific duty, such as the On Scene Leader which handles fire fighting onboard a naval ship. In the following paragraphs there is a short description of this duty and its training requirement.

1. Introduction

The On-Scene Leader (OSL) is the person responsible to check, control and guide the movement of the firefighting team onboard a naval ship. He/she assumes duties as soon as a fire alarm is sounded and takes position near the fire, in order to establish control and communications with the ship's command element. A usual chain of command organizational structure for a Harbor Fire and Emergency Party on a frigate is as follows (Royal Navy, 1999):

The OSL has immediate communication with the Officer of the Day (OOD), who is responsible for the whole firefighting process. The OOD will usually place himself in a proper position where he can control the movement of the firefighting teams without putting them in danger (e.g., smoke exposure).

The method of fighting a fire is as follows:

a. The person who discovers the fire raises the alarm and tries to extinguish the fire by every immediately available means (e.g., water, extinguisher).

b. The Initial Attack Party proceeds immediately to the scene without any breathing apparatus and assumes its duties.

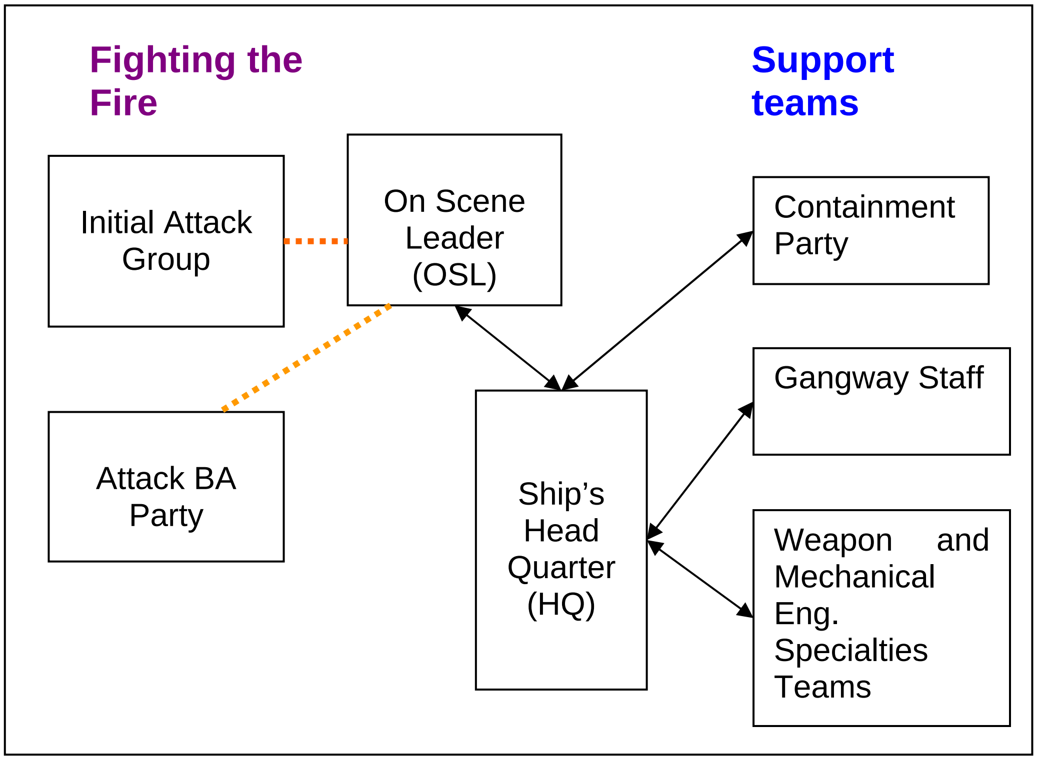


Figure 7. Frigate Harbor Fire & Emergency Party Organization

c. The OSL proceeds to the scene and assumes duties as well. He/she must be informed of how many people are inside the compartment and make sure that the door to the burning compartment remains open in order to sustain what is called Continuous and Aggressive Attack (CAAA).

d. The Attack Party proceeds to the firefighting lockers and dons proper breathing apparatus to face the smoke produced by the fire. After that, they relieve the Initial Attack Party.

Usually a fire can be extinguished during this period. If the situation gets out of control, then the teams must withdraw, the door must close and the ship's parties should prepare for what is called "re-entry." Re-entry is a very delicate process where a team—properly equipped with firefighting suits and breathing apparatus—enter the burning compartment for a short, controlled length of time. The temperatures are high enough to produce what is called heat stress (Queensland Government, 2008), and the opening of the door allows oxygen to enter the compartment, creating a "fireball blast." Therefore, the duties of the OSL are very important. He must make sure that there is an aggressive and continuous attack; he must also control how many people are inside the compartment and how long they stay, according to the oxygen supply of their breathing apparatus.

2. Training Requirement

As is obvious from the above, the training requirement for this duty assumes not only the transfer of explicit knowledge but also, and most important, knowledge of a tacit nature. Following are some examples of actions that an OSL might need to take. The mutual influence between those lines of actions, the environment within the decisions must be taken (e.g. full of smoke and excess heat), the limited time, and the potential immediate results of those actions (e.g. fire blast explosion by wrong enforcement of firefighting techniques) are all inhibitors in using the following chunks of explicit knowledge as check of list, and presuppose the thorough knowledge of the following:

a. The need to maintain a Continues and Aggressive Attack (CAAA) on a fire is a well established principle; thereby ensuring fires are extinguished at the earliest opportunity. Consideration should be given to holding a door or hatch with a water wall nozzle after the **Initial Attempt** has been beaten back.

b. The following points should be considered when deciding whether to close the door/hatch:

i. The time to supply the nozzle to the scene.
ii. Personnel to correctly and safely charge/operate the nozzle.
iii. The rig being worn by the operator.
iv. The type of compartment the fire is in.

v. The amount of water being used, to avoid collapse of the floor.

c. If the OSL is unable to contain the fire, the hatch or door should be closed.

d. The OSL must ascertain if there are any personnel trapped in the fire zone and if there are any casualties who require assistance.

e. On the withdrawal of the Attack BA personnel, the OSL must ensure that the expended firefighting appliances are moved out of the area from which the next attack is to be mounted.

f. He must request, from ship's head quarters (HQ), information on any specific hazards existing in the compartment on fire or in adjacent compartments. This information is included on compartment firefighting Kill Cards, which are held at HQ.

g. He must supervise hose running, detailing the lengths of hoses required and the type of nozzles to be used, and should be guided by the following principles:

i. Firefighting hoses must be run from separate hydrants.

ii. Sufficient hose must be provided to allow the firefighters to reach all parts of the compartment.

iii. The firefighter nozzle has a considerably lower discharge rate than the waterwall nozzle and is therefore the preferred nozzle for firefighting between decks.

iv. Waterwall and the firefighter nozzle are used for fighting carbonaceous fires.

III. EVALUATION METHOD

This chapter concentrates on the presentation of the evaluation method of the four web-based decision systems. The evaluation of the chosen four e-management tools is being held with the principles of multi-criteria (Georgopoulou et al., 1997) and multi-expert (Tsiporkova & Boeva, 2006) decision making environments using the Delphi Method (Linstone & Turoff [Eds.], 1975) as the multi-step ranking process.

Multi-criteria analysis focuses on the analysis and evaluation of different alternatives which constitute a problem demanding a decision from the decision makers. These alternatives might be different not only economically or ethically, but also in terms of social impact and acceptability. Papadopoulos & Karagiannidis (2008) said:

> [These] goals are often in conflict, so that alternative solutions differ from each other in many features. Consequently, there is no unique criterion that describes the consequences of each alternative solution adequately, and there is no single solution that optimizes all criteria simultaneously. (p. 767)

The multi-criteria decision aid method is a very important tool to deal with such kinds of problems, as it uses mathematical models which can correlate both the objectives.

A. EVALUATION STEPS

The following distinct steps are identified and processed during the procedure (Georgopoulou et al., 1997, p. 39-40):

1. Define the Problem

The problem as described in previous chapters is the effective support of managerial decisions concerning the efficient flow of tacit knowledge underlying training of the On-Scene Leader among geographically dispersed units, using web-based decision support systems (DSS).

2. Selection of Evaluation Criteria

The criteria for this evaluation are derived from the Knowledge Management Systems Success Factor Summary, as described by Jennex and Olfman (2004, p. 4). The author believes that e-management tools can be considered KMS systems as they fit well the definition given by Alavi and Leidner (ctd in Jennex & Olfman, 2004), who clarify Knowledge Management Systems (KMS):

> […] as IT-based systems developed to support/ enhance the processes of knowledge creation, storage/retrieval, transfer, and application. Additionally a KMS supports knowledge management through the creation of networks based Organizational Memory, OM, and support for virtual projects teams and organizations and communities of practice. A final goal of a KMS is to support knowledge/OM creation. (p. 1)

The chosen criteria are as follows:

Table 1. KMS Success Factor Criteria

ID	Success Factor
SF1	Integrated Technical Infrastructure including networks, databases/repositories, computers, software, and KMS experts
SF2	A Knowledge Strategy that identifies users, sources, processes, storage strategy, knowledge and links to knowledge for the KMS
SF3	A common enterprise wide knowledge structure that is clearly articulated and easily understood
SF4	Motivation and Commitment of users, including incentives and training
SF5	An organizational culture that supports learning and the sharing and use of knowledge
SF6	Senior Management support including allocation of resources, leadership, and providing training
SF7	Measures are established to assess the impacts of the KMS and the use of knowledge as well as verifying that the right knowledge is being captured
SF8	There is a clear goal and purpose for the KMS
SF9	The search, retrieval, and visualization functions of the KMS support easy knowledge use
SF10	Work processes are designed that incorporate knowledge capture and use
SF11	Learning Organization
SF12	Security/protection of knowledge

3. Definition of Criteria Weights (Criteria x Experts)

The relative importance of each criterion will be individually judged by each expert. Each expert is given the freedom to assign a vector of weights (Tsirporova & Boeva, 2006); therefore, for six experts the following table is generated:

$$W = \begin{pmatrix} w_{11} & \cdots & w_{1i} \\ \vdots & \ddots & \vdots \\ w_{m1} & \cdots & w_{mi} \end{pmatrix}$$

Where $\sum_{j=1}^{m} w_{ji} = 1$ and $w_{ji} \in [0,1]$, for i= 1, …, 6 representing the number of experts and m=12 representing the number of criteria.

4. Aggregation of Performances

The technique which is being used for the multi-step ranking method of the chosen e-management tools is the Policy Delphi Method (Turoff, 1975). This method "…is merely an organized method for correlating views and information pertaining to a specific policy area and for allowing the respondents representing such views and information the opportunity to react to and assess differing viewpoints" (Turoff, 1975, p. 87).

The group of experts that is chosen consists of six officers from the Naval Postgraduate School. As Brockhoff (1975) mentions:

> It may seem natural to study group performance of groups with a considerable number of members. However, (…) we have deliberately concentrated on small groups of four to eleven people. One reason for this is that very many small and medium-sized organizations are applying Delphi. They can call in only small groups of experts. (p. 293)

The experts have no communication among themselves and include representatives from the U.S. Navy (2), Greek Navy (2), U.S. Air Force (1) and Ukrainian Security Force (1). The choice of our experts was done seeking a satisfactory diversification. In the following table 2, we can see the characteristics of our experts.

Table 2. Characteristics of the experts.

Characteristics			
Country	US (3)	Greece(2)	Ukraine(1)
Firefighting Experience	Yes(4)	No(2)	
Service	Navy(4)	Air Force(1)	Security Forces(1)

The invitation letter and the personal data sheet that were sent to them are shown in Appendix A and B. Three rounds are conducted to attain the highest results (Turoff, 1975, p. 88; Brockhoff, 1975, p. 320), as follows:

i. In the first round, the author presents the four DSS to the experts and asks them to evaluate each of the four systems on a 7-point Likert Scale (Uebersax, 2006), based on how each satisfies the Success Factor Criteria from the above table 1 (Appendix C). At the end of each evaluation, the experts are requested to write a small explanation about their evaluation.

ii. In the second round, the experts are requested to revaluate the programs, but this time they read the evaluations and comments of the other experts (Appendix D). The given numbers are the combination of the values Xi over the different criteria for each system i= 1,…,4 according to the weights wi assigned by each expert. Thus, a vector y_i of six new values is generated, one for each expert and for each system after aggregation (Tsiporkova & Boeva, 2006) as follows:

$$Y = \left(y_1, \ldots\ldots, y_4\right) = \begin{pmatrix} y_{11} & \cdots & y_{14} \\ \vdots & \ddots & \vdots \\ y_{61} & \cdots & y_{64} \end{pmatrix} = W^T \times X = \begin{pmatrix} w_1^T x_1 & \cdots & w_1^T x_4 \\ \vdots & \ddots & \vdots \\ w_6^T x_1 & \cdots & w_6^T x_4 \end{pmatrix}$$

These new values are given to the experts for their reactions and assessments of the differing viewpoints.

iii. The third round is a repetition of the second round, where the new evaluations are being processed with the previous procedure (Appendix E). The final value for each system is the average of the final evaluation from each expert. The dominant system is the one with the highest value among all the systems.

IV. CANDIDATE SYSTEMS

This chapter focuses on the presentation of the e-management candidate systems. To re-iterate briefly from Chapter II, common to all these systems is the programming language, which is much simpler than third-generation programming languages (e.g., Java) and which could, with minor modifications, be copy/pasted between the systems. This language is similar to spoken language, and therefore is more user-friendly (Beroggi, 2005). The presentation of each system consists of a general overview, including strengths and weaknesses.

A. ADOBE DIRECTOR

The first system under evaluation is the **Adobe® Director®** (formerly *Macromedia Director*), a media application that allows users to build applications on a movie metaphor, with the user as the "director" of the “movie” (Wikipedia, 2008).

1. Strengths

The use of the programming language *Lingo* gives the capability to assign scripts to objects, and to control the behavior of the objects and the interactions with the user (Beroggi, 2005). The Score window (top left of Figure 8) shows the sequencing of the events. The events, which play the roles of “actors” in a movie, can be shown on the bottom right side of the screen. The system supports a series of “behaviors” that can be assigned to the cast members.

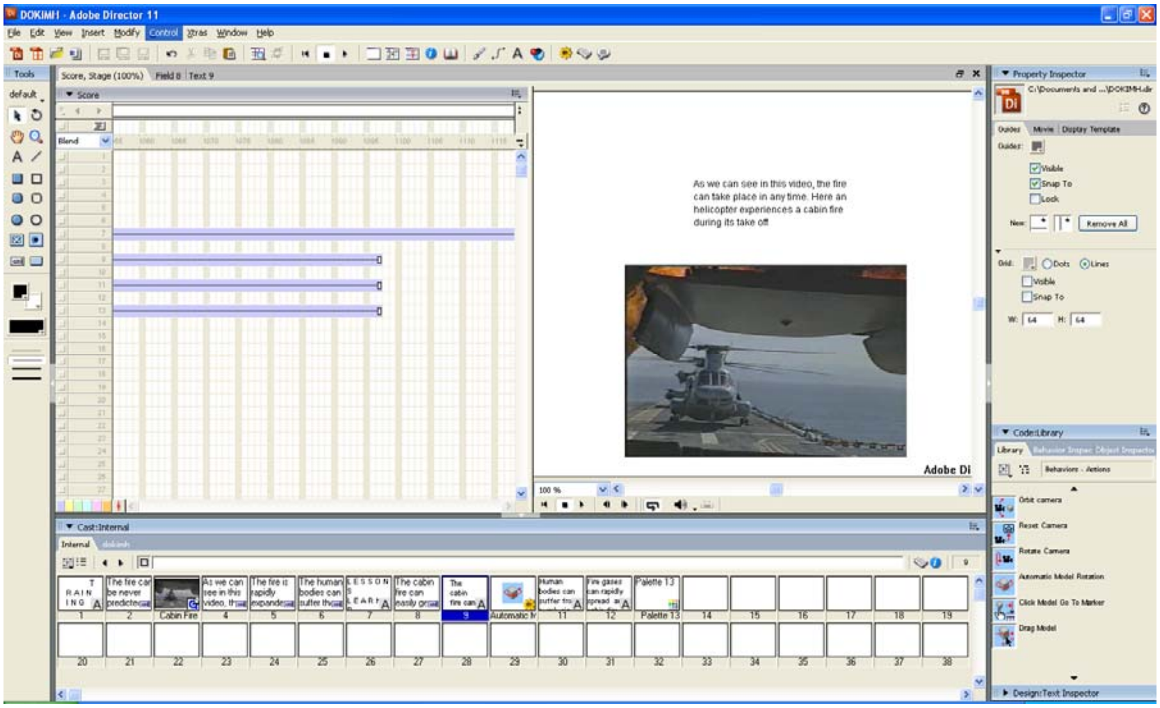


Figure 8. Programming Environment of *Director*

Furthermore, the system can support a collaborative work environment where two users can exchange information and even chat over the Internet (Beroggi, 2005, p. 212). This can be done through the Library window, as shown in Figure 9. Finally, it can support both 2D and 3D multimedia projects, providing a basis to create computer-based training for enhanced knowledge flow.

2. Weaknesses

Although this system can support basic mathematical functions and operations necessary to create the decision support models, these can only be programmed using *Lingo*. This is in contrast to systems like i-Think and Powersim (discussed later in this chapter), where the models can be created by just dragging flow and stocks and using predefined functions that already exist in the main menu toolbar.

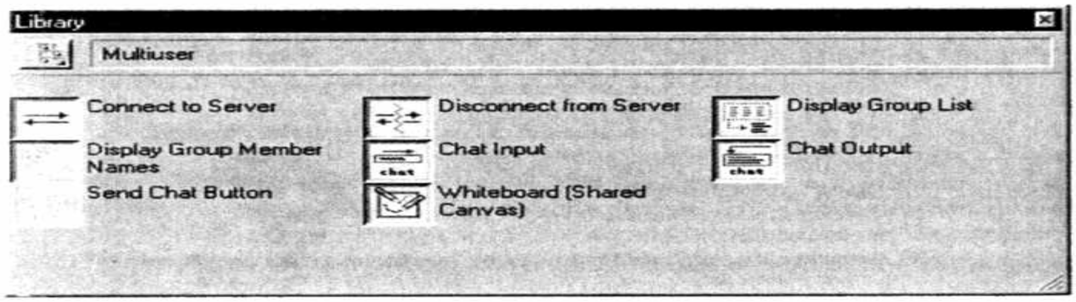


Figure 9. Multi-user behaviors in *Director* (After: Beroggi, 2005)

In the panel evaluation described below, Adobe Director presents a small video clip of a fire onboard a helicopter during takeoff (Figure 10). It presents some characteristics of the system, such as 3D modeling and the employment of mentoring characteristics and on-the-job training (OJT).

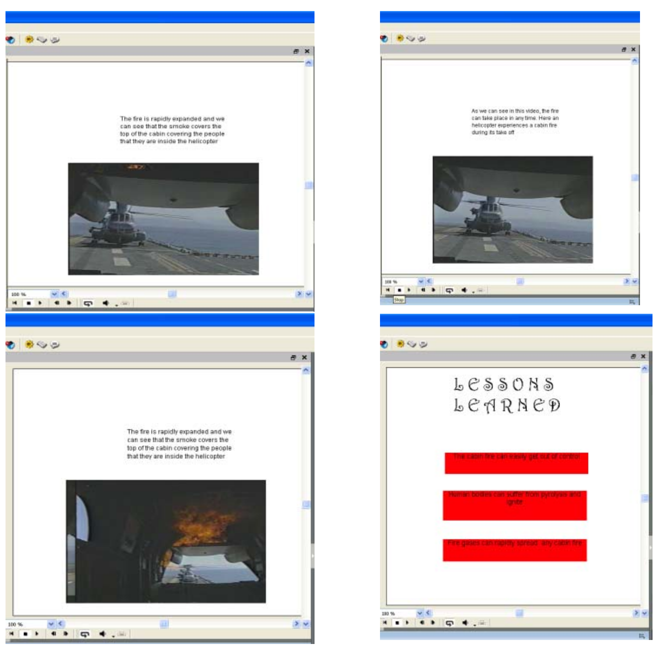


Figure 10. Training on Cabin Fires as created in *Director* environment

B. METACARD (REVOLUTION)

MetaCard® is a multimedia authoring tool and Graphical User Interface (GUI) (Raymond & Landley, 2004) development environment. Using MetaCard is an easy way to build graphical applications, Computer Based Training (CBT), on-line documentation, and a wide variety of other products.

1. Strengths

Metacard supports an advanced graphical Integrated Development Environment (IDE) that uses "scripting languages that were designed to be used with a text editor and console window" (Yet another Platform for Metacard, 2001). The multiple-card metaphor and hypertext-linking capability make it a natural for producing on-line reference manuals. As an example, the complete documentation for the Metacard environment itself is available online in Metacard stacks.

Moreover, Metacard also has multimedia capabilities comparable to Adobe Director and a slide-oriented format found in presentation tools like PowerPoint. Metacard uses the MetaTalk language, which is compatible with the Hypertalk (used in HyperCard) (Apple Computer, 1991) and Supertalk (used in SuperCard) languages (Crooks II, 1999). The main advantage of Metatalk is that, although it has the common features of third-generation languages such as Java or C++, it is much simpler and employs simple English syntax.

2. Weaknesses

Although the complete documentation for the Metacard environment is available online, it consists of more than 300 pages, making it very difficult to read and understand without proper training.

In the panel evaluation described below, Metacard/Revolution presents two small demos. The first one is an Internet-based movie theater finder, which is a simple demonstration of how it can correlate different documents and files. A screenshot is presented in Figure 11. This demo searches the Internet and presents film playing times in the area of the specified ZIP code.

Figure 11. The Movie Locator provided by isnoop.net

The second demo is a short game that shows how an interactive connection between the user and the teacher in a training session can be accomplished. A screenshot is presented in Figure 12.

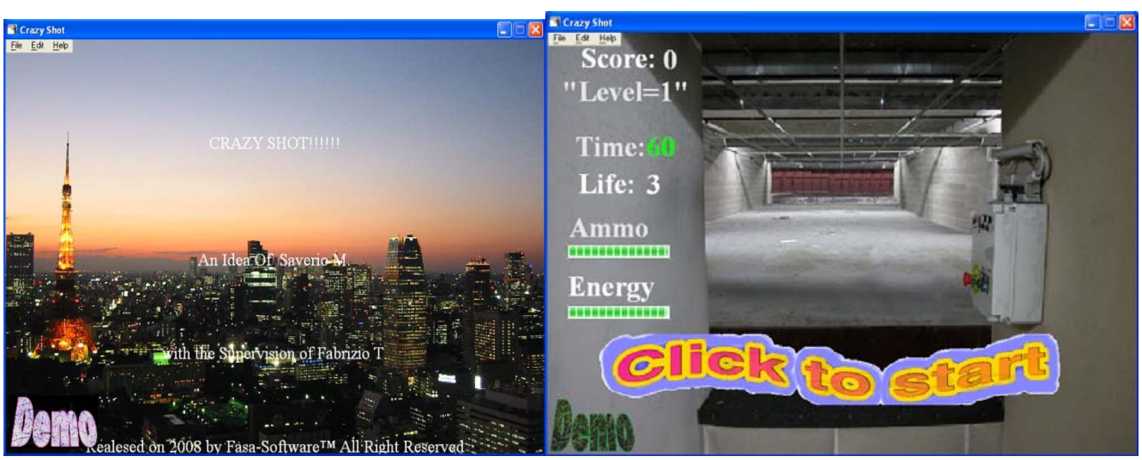


Figure 12. “Crazy Shot” demo in Revolution Studio by Fasa-Software

C. SUPERCARD

SuperCard® is also inspired by HyperCard, with a high-level development environment that runs on Macintosh computers. It can be a multimedia authoring system, an Internet development tool, or an application prototyping or production tool.

1. Strengths

The programming language used by SuperCard is called SuperTalk. One of the advantages of Supercard it that it uses near-plain English like Director's *Lingo*, but is considered a more complete language than either HyperTalk or Lingo (Martin, 1997). Similar to Metacard, Supercard uses the card/stack/window metaphor and can support various movie formats like Quick Time.

Furthermore, Supercard has a web browser plug-in which allows it to be embedded in web pages and resolve some of the issues of the Internet like slow access. The projects prepared in Supercard can be turned into standalone applications, which make them easy to transfer and useful for creating computer based training.

2. Weaknesses

Although Supercard can be considered a capable e-management tool, it is not evaluated below because it runs exclusively on the Macintosh platform. With the majority of military computers running on Microsoft operating systems, it will be pointless to judge a system that would require the replacement of the present system and probably budget overruns to replace computers or software.

D. I-THINK

The i-Think® model offers a way to make decisions through creation of models that simulate the organization's processes and what actually affect them.

1. Strengths

i-Think uses a number of stocks, flows and causal loops that are being used by System Dynamic theories (Sterman, 2000). It enables a user to model how a system works. It depicts the causal loops that affect a system, and through mathematical expressions tries to depict system outputs, which can be quite different from intuitive estimates made by people; this is the case in particular for complex systems with feedback loops and delays.

2. Weaknesses

Although i-Think supports decision making, the system itself appears incapable of being used for knowledge transfer via e-learning or computer based training. The equation portion (Figure 16) can give the user a very good sense of the parameters that affect the system and to what degree those parameters are correlated to one another.

In the panel evaluation described below, i-Think presents a model (Sterman, 2000, p. 491) that depicts the correlation of output of an organization's "rookie" employees with enforcement of mentoring and OJT (WMO), and without mentoring and OJT (WNMO) (Figure 13).

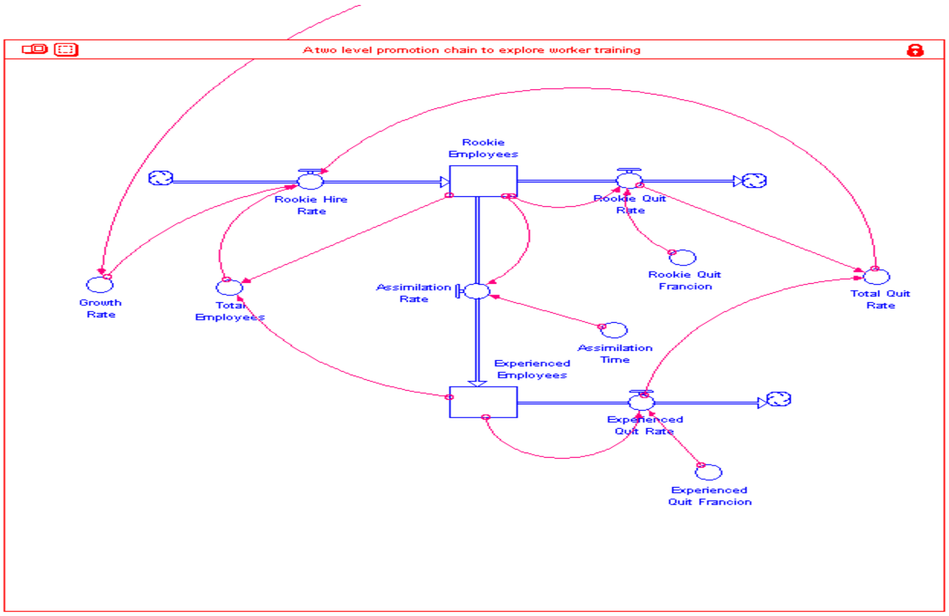


Figure 13. A two-level promotion chain model to explore worker training, created in the i-Think environment

The working environment of i-Think can be seen in Figure 14.

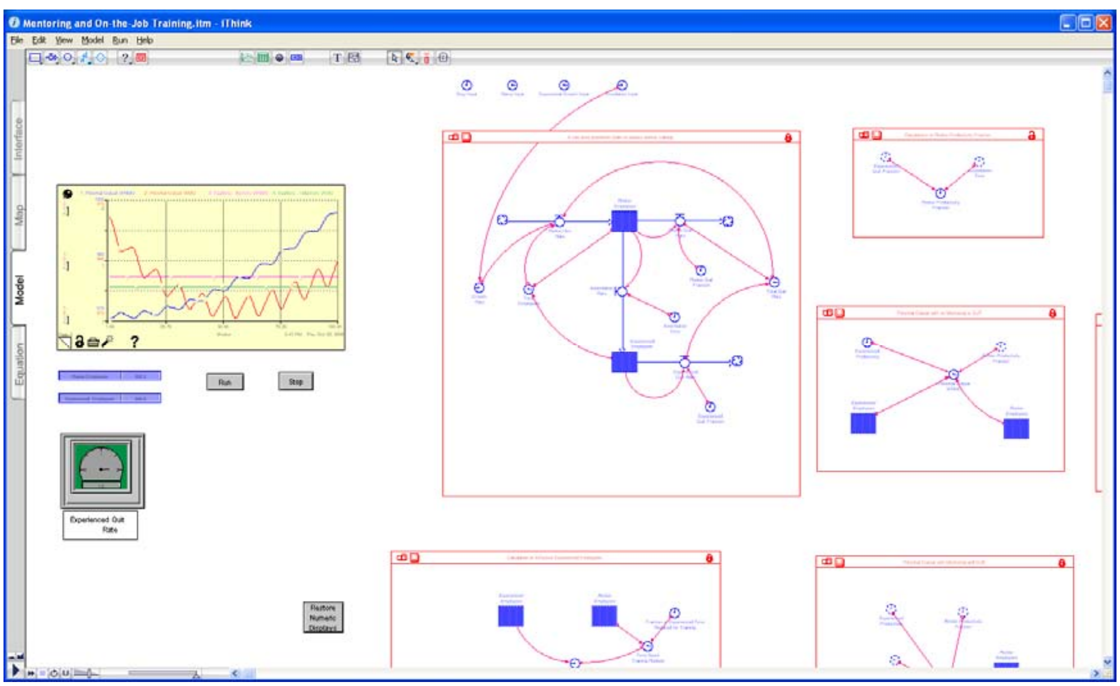


Figure 14. Working environment of i-Think

The final results of the designed models can be depicted in a number of graphs like the one in Figure 15. Notice that the output of the organization without mentoring and OJT (WNMO) is greater than the potential output of the organizational effectiveness if the experienced workers give half of their time for mentoring and OJT. Therefore, by running a number of sensitivity tests, the best combination of factors for the best potential output can be calculated. The system, on a separate page, can provide the number of formulas that are being used by the model (Figure 16) for better understanding of the situation.

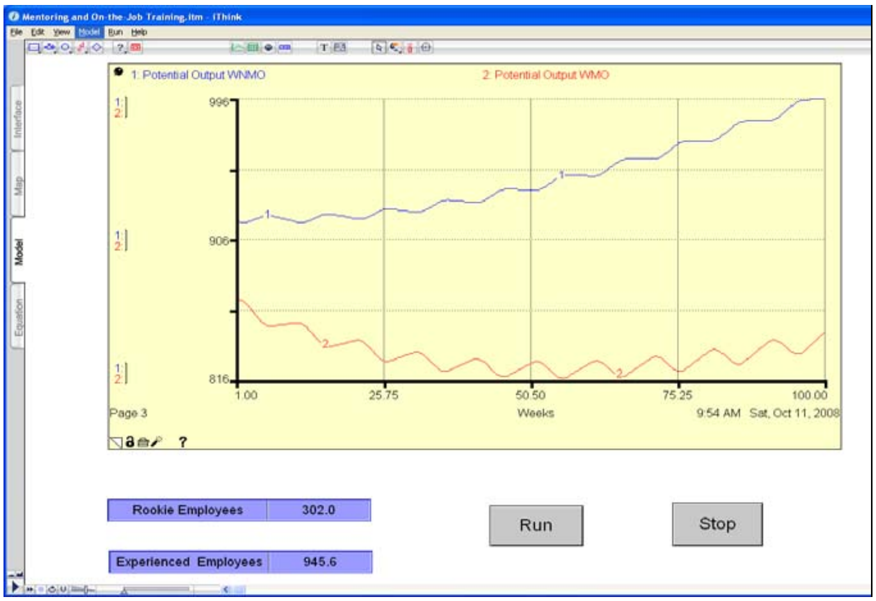


Figure 15. Graph Pad generated by running the model in i-Think

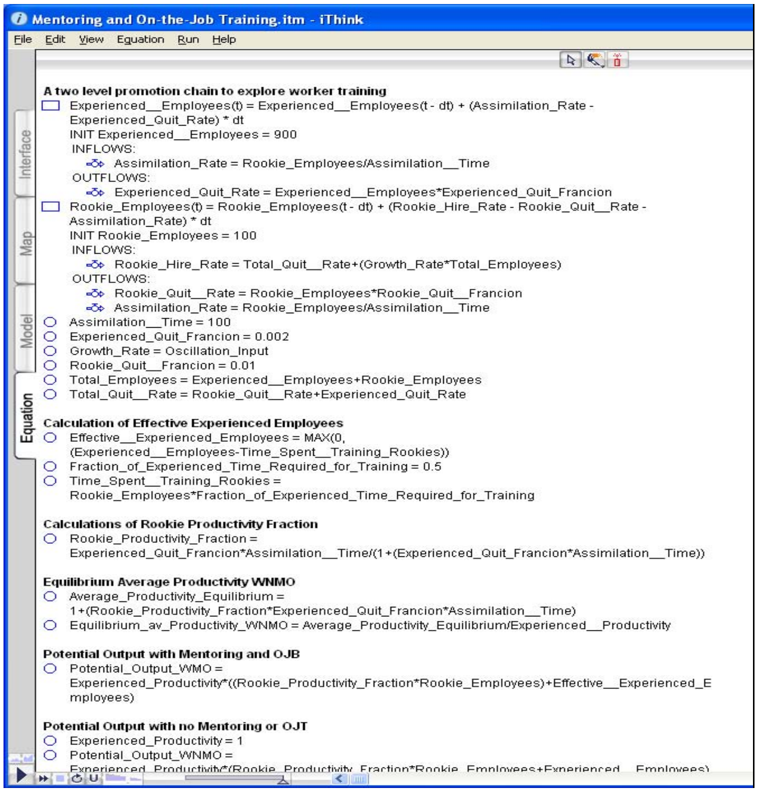


Figure 16. Equation page of the i-Think environment

E. POWERSIM SYSTEM

Powersim® Software's Studio is also an integrated environment for building and running business simulation models on the Microsoft® Windows Platform.

1. Strengths

Powersim has the same strengths as i-Think, using the same principles from System Dynamic. Moreover, it includes a software library that can be used by programmers to include simulations in custom-designed software applications. Software developers can use such libraries to develop simulations for the Web as well as desktop applications to be run in the Microsoft® Windows environment.

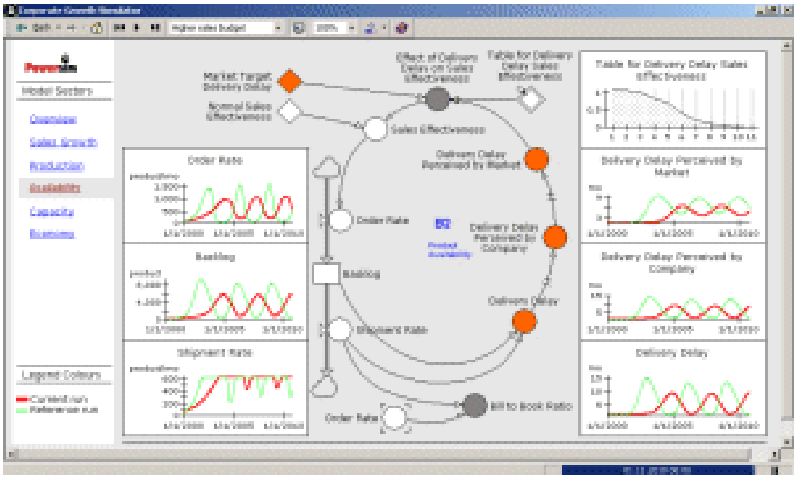


Figure 17. Software applications by Powersim (Copyright Powersim Software AS ©2008)

What differentiate this system from i-Think are a richer library of functions and the use of arrays. The user can very easily create models by dragging flows and stocks from the screen's menu and designating the appropriate values that depict their correlation.

2. Weaknesses

As discussed for *i-Think*, Powersim appears incapable of being used for knowledge transfer via e-learning or computer-based training.

In the panel evaluation described below, Powersim presents the same two-level promotion chain model that is used for i-Think (Figure 18).

The output of this simulation can be seen with the diagrams and graphs in Figure 19.

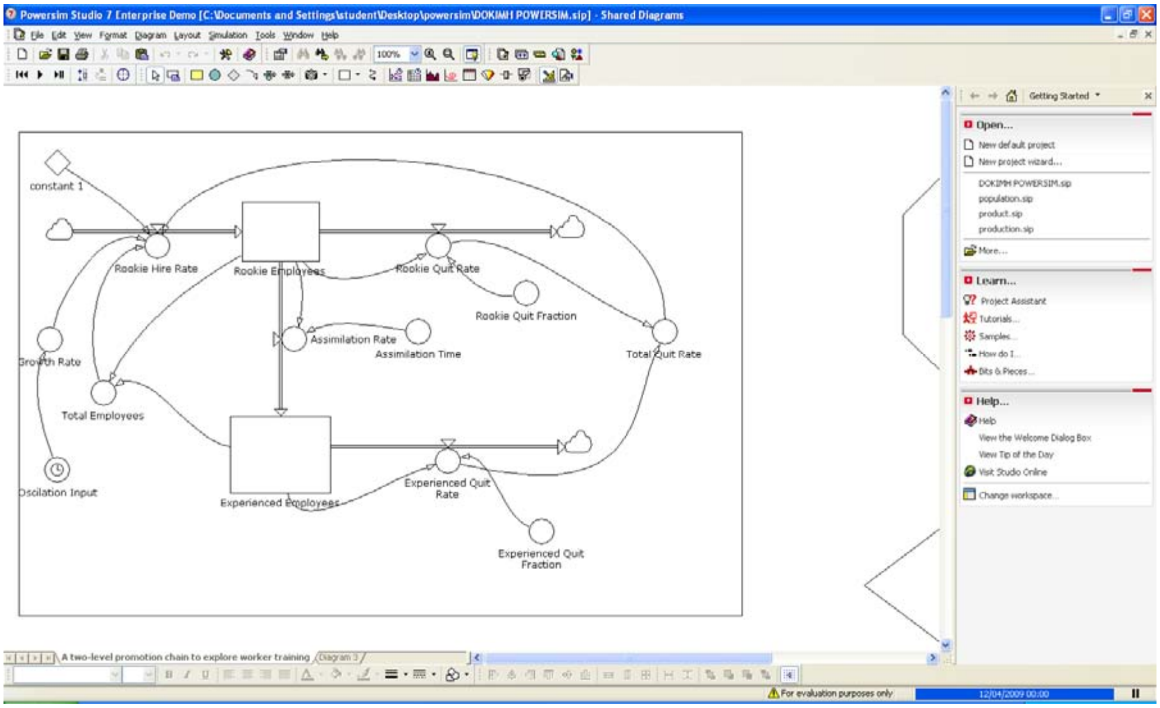


Figure 18. Two-level promotion chain model to explore working training

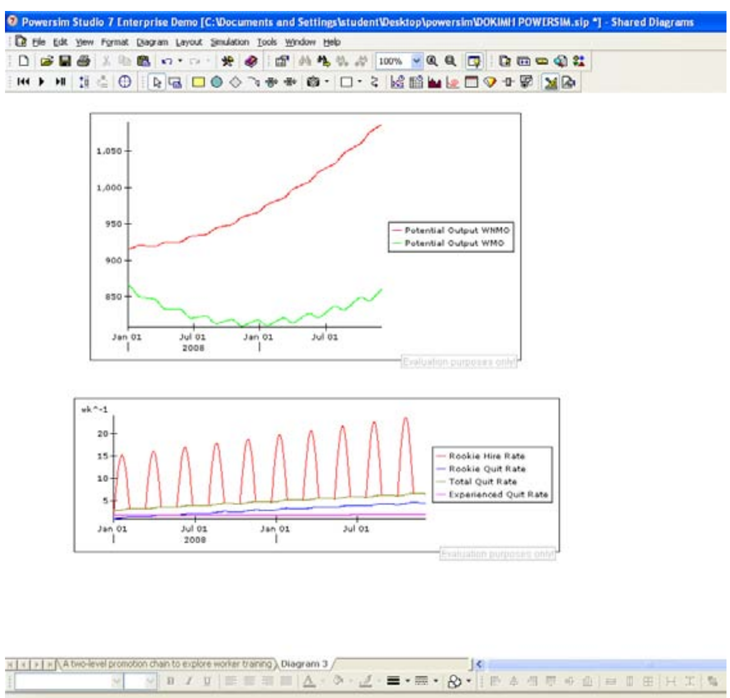


Figure 19. Graphs generated by running the model in Powersim

V. RESULTS

This chapter concentrates on the presentation of the results from the evaluation of the four web-based decision systems. As described in Chapter III, the evaluation of the chosen five e-management tools was conducted with the principles of multi-criteria (Georgopoulou et al., 1997) and multi-expert (Tsiporkova & Boeva, 2006) decision making environments using the Delphi Method (Linstone & Turoff, 1975).

The first part of the evaluation questionnaire was the assessment of the relative importance of each of the Success Factors (SF). The results obtained from the Delphi panel are shown in Figure 20. Each individual dot on the figure represents the relative importance assigned from each expert for each success factor (horizontal axis).

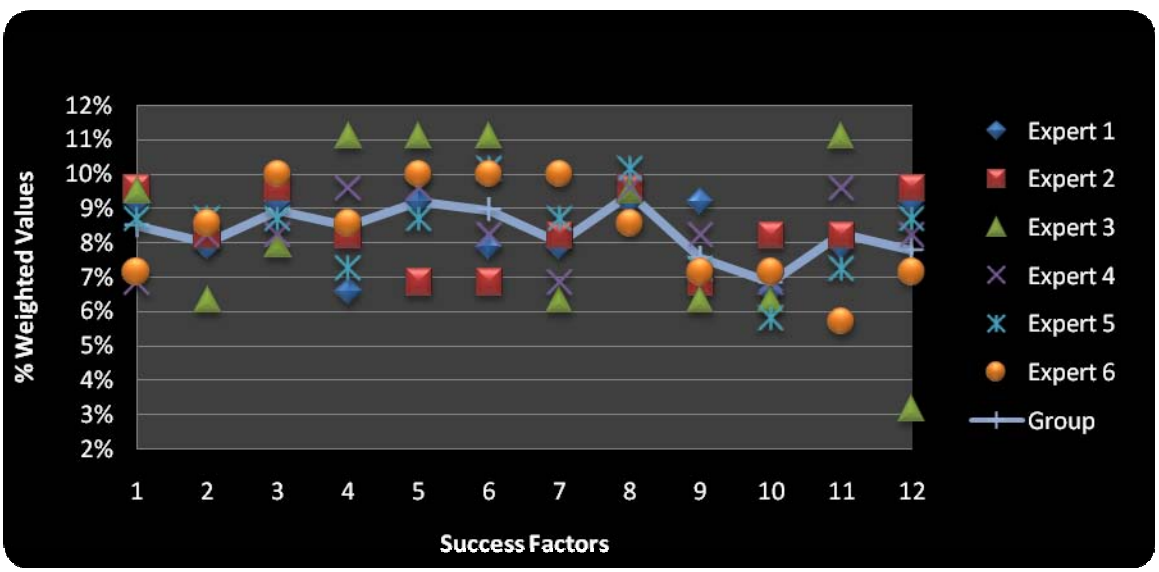
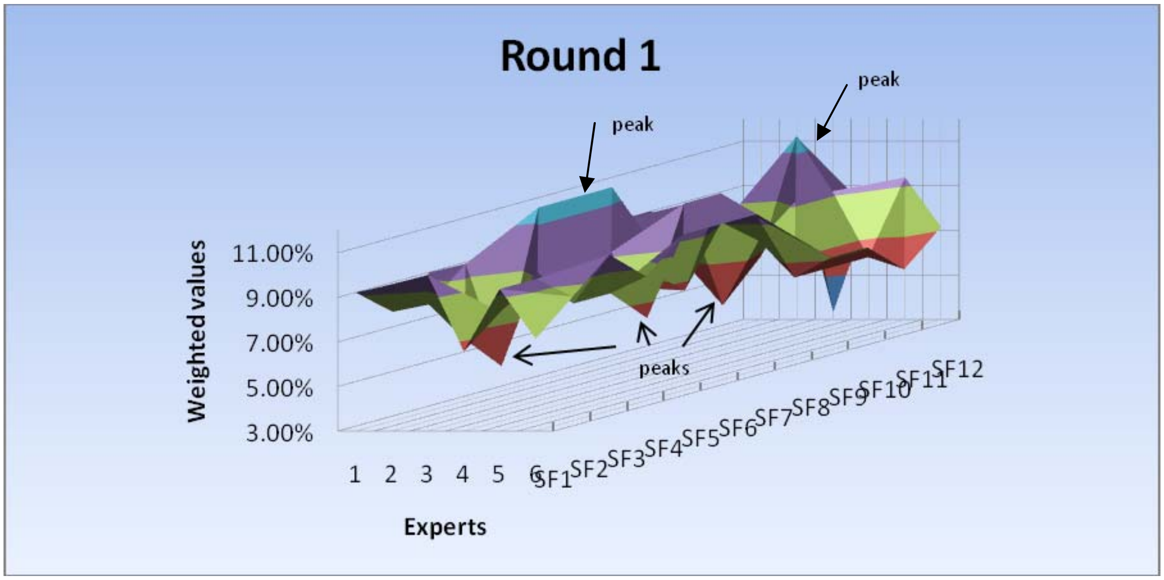


Figure 20. Weighted Values for each Success Factor from each Expert

The constant line represents the average relative importance extracted from the Delphi panel. Therefore, for Success Factor 1, Experts 1, 2 and 3 assigned a relative importance close to 9.5%, whereas Expert 5 was close to the average of 8.5% and Experts 4 and 6 below the average (6.9% and 7.2%). The relative average importance of 8.5% for Success Factor 1 is translated as the coefficient of this success factor in the equation of the absolute perfect (100% successful) Knowledge Management System (KMS).

The consensus of the panel during the evaluation is shown in Figure 21, which represents, in three dimensions (3D), the first and the final rounds in Figure 20. It can be seen that the peaks observed in round one, depicted with blue and brown color, have been smoothed to a certain degree through the final round. Those peaks refer mainly to the evaluation from Expert 3 for Success Factors 3, 4, 5, 6 and 8.



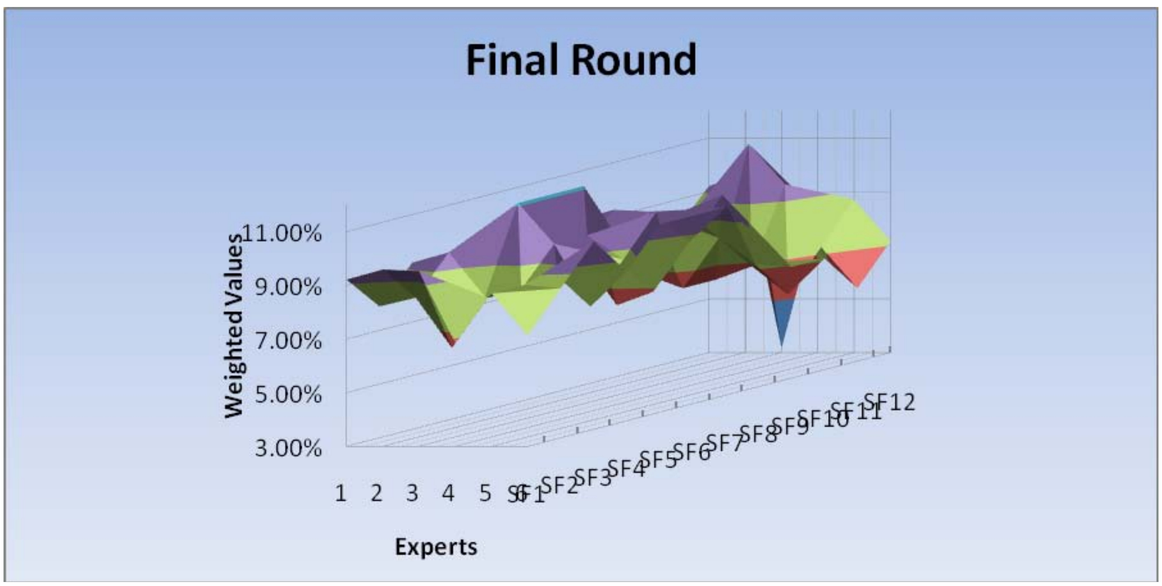


Figure 21. Consensus from Delphi panel about the Success Factors' weighted values

The second part of the evaluation was the evaluation of the candidate e-management tools and how they can efficiently and effectively support each of the success factors as described in Table 1 (Chapter III) and re-iterated briefly in the following Table 3.

Table 3. Success Factors

ID	Brief Description
SF1	Integrating technical infrastructure
SF2	Identifying users
SF3	Clear knowledge structure
SF4	Motivation and commitment of users
SF5	Organizational culture supporting learning.
SF6	Senior management support
SF7	Established Measurement.
SF8	Clear goal and purpose
SF9	Easy knowledge use.
SF10	Proper work processes design
SF11	Learning organization
SF12	Security

The results from this evaluation, by system, are shown in Figures 22 to 25 below. Each column represents the evaluation on a 7-point Likert Scale (vertical axis), from each expert for the specified success factor (horizontal axis).

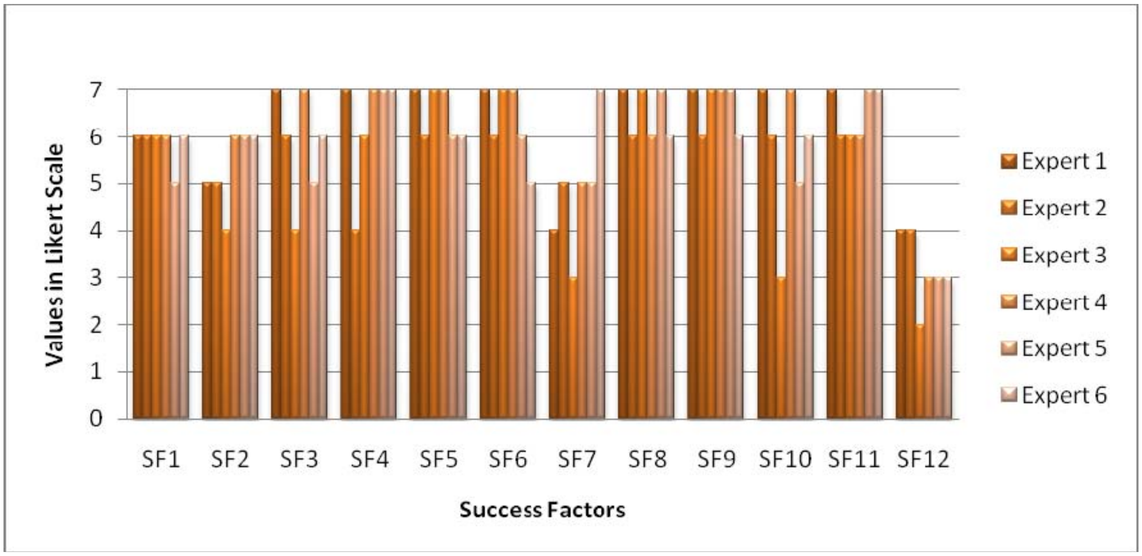


Figure 22. Results from the evaluation of Director

Director appears prominently in the majority of the Success Factors, scoring seven (7) from at least two of the experts in eight out of twelve SFs. It seems to suffer from a trend of low scoring by Expert 3 and perfect scoring (e.g., seven) from Expert 1. The relatively low evaluation in SF12, concerning security of knowledge, characterizes the other systems also and is discussed below.

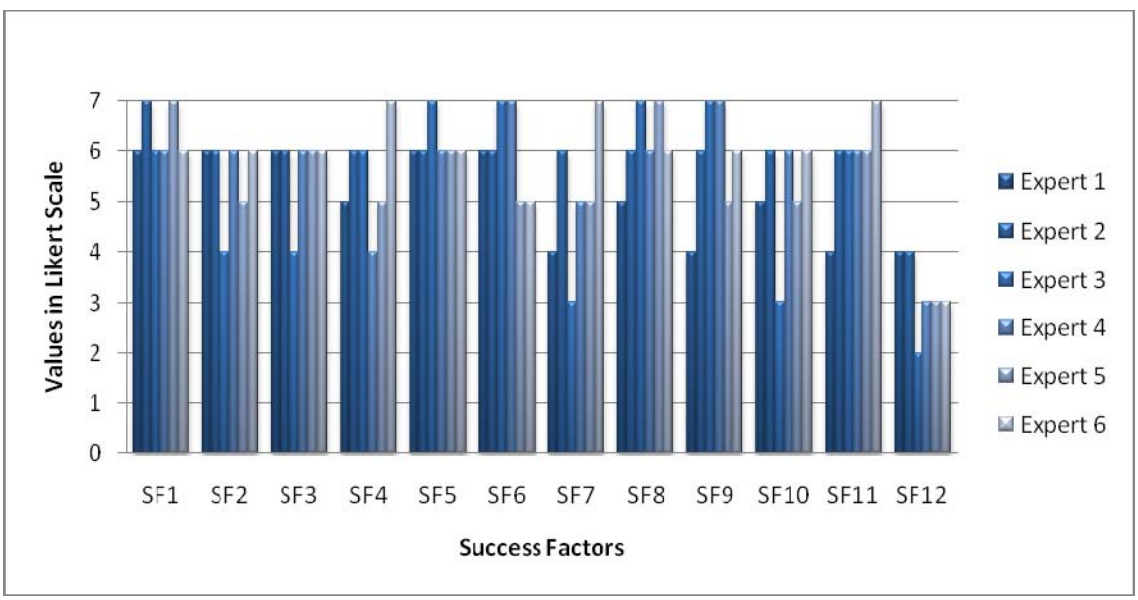


Figure 23. Results from the evaluation of Metacard

Metacard, on the other hand, appears to be steadier in its evaluation. Ratings from the majority of experts fluctuate around the value of six in most of the SFs. Again, there is a trend of lower evaluation from Expert 3 in half of the SFs, which is balanced by a higher scoring on four of them.

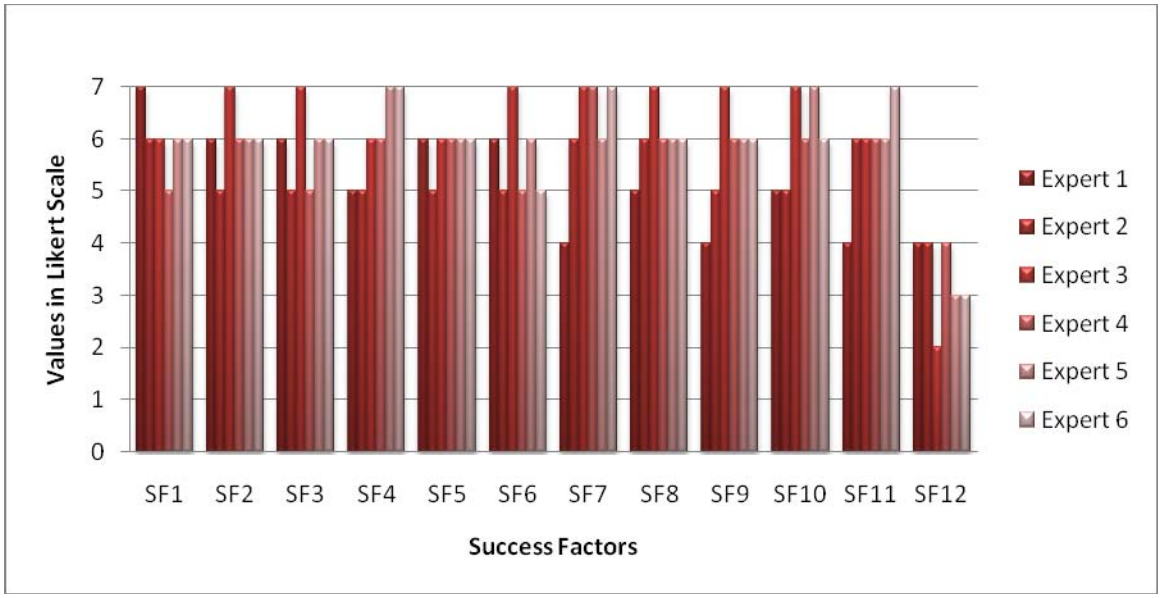


Figure 24. Results from the evaluation of Powersim

The Powersim evaluation continues the prominent trend of the previous two systems. It fluctuates around the value of six, with the bigger inclination from Expert 1 in SF7 (established measurement), 9 (easy knowledge use), and 11 (learning organization).

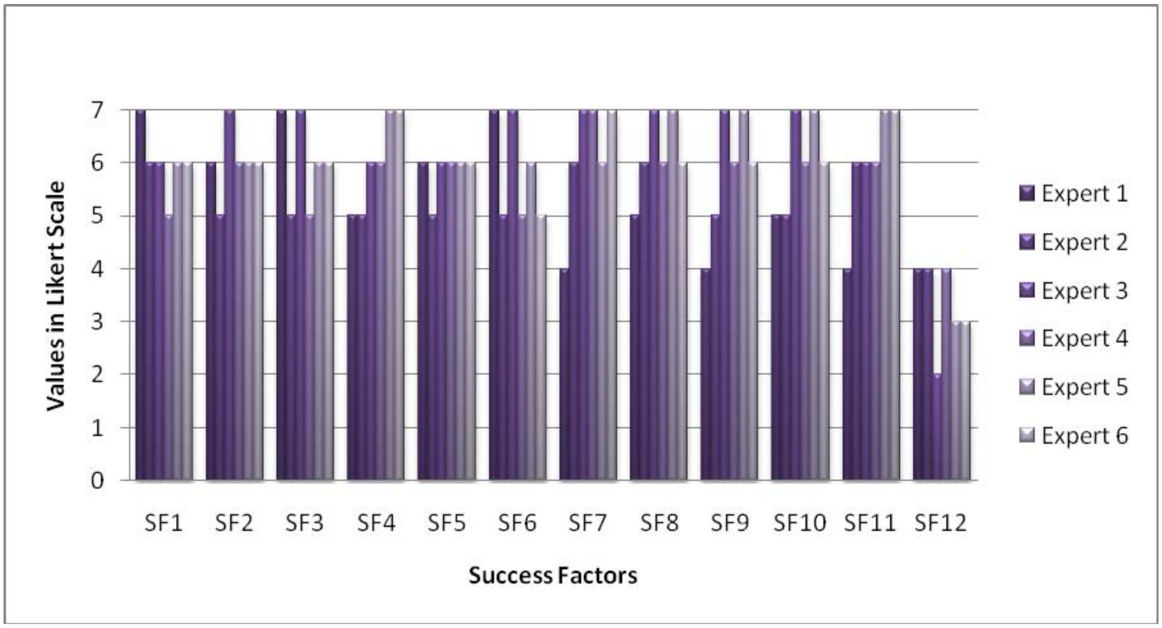


Figure 25. Results from the evaluation of i-Think

The results from the evaluation of i-Think are almost identical with those of Powersim. This seems logical as both of them are based on the same principles. The only differences come from Expert 1 for SF 3 (clear knowledge structure), and 6 (senior management support), where i-Think gets a bigger score.

The average evaluation for each system (across all experts), again on a 7-point Likert Scale (vertical axis) for the specified success factor (horizontal axis), is described in Figure 26.

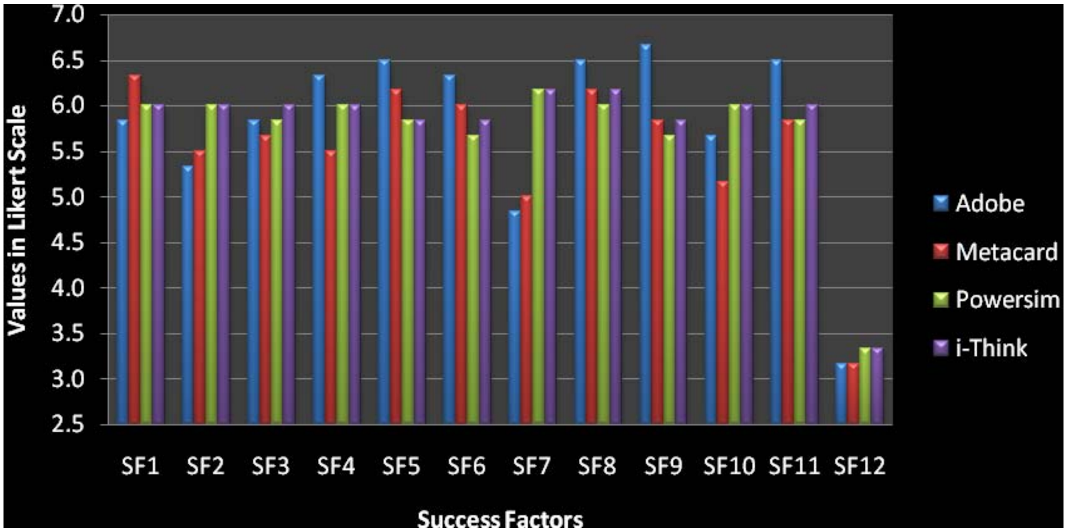


Figure 26. Average values for each system across all experts

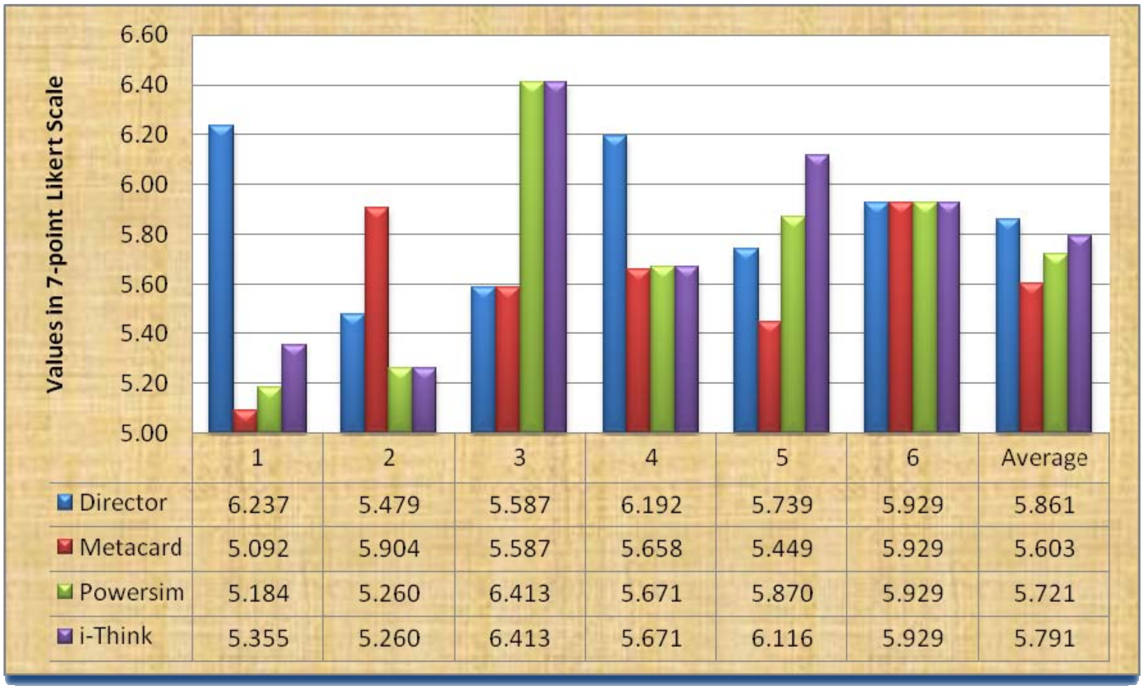
The four e-management tools can be broadly divided into two main categories. The first one consists of the multimedia application systems Director and Metacard (Crooks II, 1999), while the second category consists of the two systems (e.g., Powersim and i-Think) based on the System Dynamic principles (Sterman, 2000). Results summarized in Table 4 show that systems within each of these categories perform better in terms of related success factors.

Table 4. Dominating systems among the success factors

Category	Representative	SF
Multimedia Systems	Metacard	Integrating technical infrastructure (1)
	Director	Motivation and commitment of users (4)
	Director	Organizational culture supporting learning (5)
	Director	Senior management support (6)
	Director	Clear goal and purpose (8)
	Director	Easy knowledge use (9)
	Director	Learning organization (11)
System Dynamic Family	i-Think & Powersim	Identifying users (2)
	i-Think	Clear knowledge structure (3)
	i-Think & Powersim	Established measurement (7)
	i-Think & Powersim	Proper work processes design (10)
	i-Think & Powersim	Security (12)

Specifically, the systems with multimedia abilities score higher on success factors that pertain more to efficiency, while the other group have higher scoring on success factors that pertain more to effectiveness of knowledge flow. Based on these results, the Delphi panel was called to decide which combination of the above systems they would like to see working together. The panel as a whole suggested that the combination of *Director* with *i-Think* would possibly be more suitable to fulfill all the success factors and provide the best support on tacit knowledge flow, as the two systems would get the better of eleven out of twelve success factors (as can be seen in Figure 26).

By aggregating the results from Figures 20-25, as described in Chapter III, a new vector y_i of six new values was generated, one for each expert and for each system as depicted in Figure 27. The average value for each of the four systems appears in the last column of the chart.



	1	2	3	4	5	6	Average
Director	6.237	5.479	5.587	6.192	5.739	5.929	5.861
Metacard	5.092	5.904	5.587	5.658	5.449	5.929	5.603
Powersim	5.184	5.260	6.413	5.671	5.870	5.929	5.721
i-Think	5.355	5.260	6.413	5.671	6.116	5.929	5.791

Figure 27. Aggregated results from systems' evaluation

The system with the highest average score is the *Director*, with a mean value of 5.861 on a seven-point Likert Scale, as shown in the above figure. The fact that all of the systems score between 5.6 and 5.9, and even the ones with lower average value like *Powersim* and *i-Think* score over 6 by at least one expert, suggests that any of these systems offers good potential as a tool for efficient and effective tacit knowledge flow.

The evaluation of the four e-management tools takes place through the lenses of the specific organization (e.g., military) and for a specific duty (e.g., On Scene Leader). More research is needed to generalize the results to other types of organizations and different duties that presuppose the flow of tacit knowledge.

The low evaluation of the candidate e-management tools on Success Factor 12 (concerning security) was something else that caught the attention of the panel. The systems themselves are vulnerable to unauthorized access, as they are all web-based. However, the members of the panel expressed confidence that the system can work in a virtual environment, properly protected by the appropriate security. Because the topic of discussion is training among military units, security of the transferred knowledge is especially important.

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VI. CONCLUSION

The first part of this chapter is mainly a summary of key findings from previous chapters. The second part discusses the limitations of this paper. The final part offers suggestions for future research.

A. SUMMARY OF KEY FINDINGS

This thesis seeks to answer the central research question of how e-management can contribute to effective, geographically dispersed training where tacit knowledge is required to flow. The research question derived from the reality of military services around the world operating increasingly with great geographical separation between units. Combined with the never ceasing, fast operational tempo of such services, this creates problems in terms of training. On the other hand, e-management as it is understood today does not inform training programs' decisions makers adequately to address these problems effectively. In particular, because much of the important knowledge associated with training is tacit in nature, it remains unclear how such tacit knowledge can flow effectively via the network technologies underlying e-management.

Various training methods have been used by the various types of organizations providing the important bases of knowledge flow. Those systems and methodologies can unarguably support the flow of explicit knowledge, but the absence of mentoring, face-to-face interaction and on-the-job training are inhibitors to tacit knowledge flow. The duty of On Scene Leader, who handles fire fighting onboard a naval ship, is one of those collateral duties that cause problems due to the extended training requirement and the big chunks of tacit knowledge needed to be passed on.

Results of the Delphi evaluation discussed above indicate that *Adobe Director* is marginally superior in terms of the success factors described as prerequisites for the success of a Knowledge Management System. This suggests that it can be used as an effective decision support system to support the goal of Organizational Learning and effectively contribute to the tacit knowledge flow among geographically dispersed military units. However, because all of the evaluated systems score between 5.6 and 5.9, this indicates that any of these systems can serve effectively as a tool for an efficient and effective tacit knowledge flow. This represents a contribution of new knowledge. Additionally, combining and integrating multiple systems offers even greater potential for supporting tacit knowledge flow through e-management systems.

B. LIMITATIONS

Like every study, this thesis research has limitations. First of all, the evaluation of the previously referenced e-management tools took place through the lenses of the specific duty of On Scene Leader. As described in Chapter II, the training requirement for this duty assumes not only the transfer of explicit knowledge but also, and most importantly, knowledge of a tacit nature. The mutual influence between the lines of actions which OSL has to take, the environment within which the decisions must be taken, the limited time, and the potential immediate results of those actions are all inhibitors to using the following chunks of explicit knowledge as a check-off list and will benefit from the enforcement of an e-management tool like Director—as suggested in this research. Nevertheless, more research is needed if those results can be accepted for other duties that require tacit knowledge.

The second limitation of this research is that the evaluation of the four e-management tools took place by using different models and demos for the various systems (except i-Think and Powersim, where the model was the same). The personal interaction between the author and the experts during the evaluation phase, in the aspect of solving any questions that might exist, seemed to smooth this discrepancy. Nonetheless, the experts did not have the exact same models and demos to evaluate for each system.

C. RECOMMENDATIONS FOR FUTURE RESEARCH

The results from this research should be validated through a laboratory experiment to measure the results of people using the Director system. The experiment can be performed using a number of groups that either have the benefit of using Director or must complete their experimentation tasks without it. The base of this evaluation could be the Knowledge Value Analysis or the Learning Curves theory (as cited in Nissen, 2006, p. 101-110). The experiment can be done with the purpose of either measuring the Return on Knowledge (ROK) (as cited in Nissen, 2006, p. 101) or measuring the improvement rate from the generated learning curves during the experiment.

In order to be able to perform this experiment, there should be:

i. A model that will support the flow of the required knowledge for the On Scene Leader or other duty that needs tacit knowledge to flow, either in *Java* or in *Lingo* language

ii. Training videos that will support the e-learning

iii. Chat rooms that will complement the face-to-face interaction and mentoring.

As a final consideration, there should be more research on how training can be supported more efficiently by a combination of more than one e-management tool system. The Delphi panel suggests that a combination of Director and i-Think will be the most appropriate to better fulfill the requirements of a Knowledge Management System. More research is needed to support this proposal and prove the utility of a system combining the multimedia environment of Director with the simulation and sensitivity analysis capabilities of i-Think. This research can be accomplished during the previous described experiment.

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APPENDIX A: INVITATION LETTER FOR ATTENDING THE DELPHI PANEL

Graduate School of Business
& Public Policy

Date: 09/27/2008

Dear Sir,

I am writing my thesis on how e-management can support training among geographically dispersed military units. With this letter I would like to ask for your participation as an expert in my research. A personal data sheet is enclosed. If your response is affirmative, please complete this data sheet and attach it to your email.

This thesis tries to explore ways to support the managerial decisions concerning ways of eliminating potential incidents of knowledge clumping among organizations cells, especially when these cells are geographically dispersed. It focuses on an evaluation of five Decision Support Systems, using a methodology called the Delphi approach. A group of six experts is being enlisted to accomplish the following objectives:

a. To complete an initial questionnaire concerning how those Decision Support Systems fulfill a number of Success Factor criteria which will be given. The relative importance of each criterion will be assigned by each expert, and a full explanation of the individual evaluation will be requested.

b. In the second round, the experts are requested to reevaluate the programs, but this time they read the evaluations and comments of the other experts. The given numbers are the combination of the values over the different criteria for each system, according to the weights assigned by each expert.

c. The third round is a repetition of the second round, where the new evaluations are being processed with the previous procedure. The final value for each system is the average of the final evaluation from each expert. The dominant system is the one with the highest value among all the systems.

The use of questionnaires will assure anonymity for each member and will encourage a full expression of views. The information on the personal data sheets will be used to characterize the panel in the study and for statistical analyses. There will be no specific information published on any individual.

In the following two paragraphs, you can read some thoughts that triggered the research question.

a. Military services around the world are operating increasingly with great geographical separation between units. Combined with the never ceasing, fast operational tempo of such services (especially given the global war on terror), this creates problems in terms of training. In particular, it has become very difficult to get busy, geographically dispersed personnel to classroom training courses, even though the lack of training impacts their military performance directly. Moreover, all military personnel are assigned collateral duties—many of which are very important—but many such personnel cannot engage in adequate training required to accomplish their duties well.

b. e-management is using intelligent decision tools in an Internet-based multimedia environment in order to bridge the gap between cognitive and analytic problem solving. However, e-management as we understand it today does not inform us adequately to address these problems effectively. In particular, because much of the important knowledge associated with training is tacit in nature, it remains unclear how such tacit knowledge can flow effectively via the network technologies underlying e-management. This leads to the central research question: how can e-management contribute to effective, geographically dispersed training where tacit knowledge is required to flow?

I appreciate your consideration of participation in the study and look forward to an affirmative response.

Sincerely,

Gus Xynos

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APPENDIX B: PERSONAL DATA SHEET

XYNOS DELPHI PANEL

1. Name. ____

2. Will you join the Delphi panel? (Check one) Yes ____ No ______

3. Do you have any former experience as a Training Officer? ____________

If "yes" summarize briefly without referring to specific names of units if you don't like.

4. Do you have any training in Firefighting? Yes _____ No _______

On board a naval ship? Yes _____ No _______

If "yes" summarize briefly what kind of training did you get and did you have the opportunity to practice your training?

This information is confidential and will be used in summary form only.

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APPENDIX C: DELPHI QUESTIONNAIRE ROUND ONE

DELPHI QUESTIONNAIRE CONCERNING THE EVALUATION OF
e-MANAGEMENT'S TOOLS ON HOW THEY CAN SUPPORT TRAINING
AMONG GEOGRAPHICALLY DISPERSED MILITARY UNITS

ROUND ONE

Your Name: ____

SECTION ONE

The first objective of the panel is to define the relative importance of each of the twelve criteria which will be used as success factors in our evaluation.

Using the scale below, indicate how important or relevant each of these factors is in an efficient and effective flow of knowledge.

ID	Success Factor	Most Unimportant --→ Very Important						
SF1	Integrated Technical Infrastructure including networks, databases/repositories, computers, software, and KMS experts	1	2	3	4	5	6	7
SF2	A Knowledge Strategy that identifies users, sources, processes, storage strategy, knowledge and links to knowledge for the KMS	1	2	3	4	5	6	7
SF3	A common enterprise wide knowledge structure that is clearly articulated and easily understood	1	2	3	4	5	6	7

SF4	Motivation and Commitment of users, including incentives and training	1	2	3	4	5	6	7
SF5	An organizational culture that supports learning and the sharing and use of knowledge	1	2	3	4	5	6	7
SF6	Senior Management support including allocation of resources, leadership, and providing training	1	2	3	4	5	6	7
SF7	Measures are established to assess the impacts of the KMS and the use of knowledge as well as verifying that the right knowledge is being captured	1	2	3	4	5	6	7
SF8	There is a clear goal and purpose for the KMS	1	2	3	4	5	6	7
SF9	The search, retrieval, and visualization functions of the KMS support easy knowledge use	1	2	3	4	5	6	7
SF10	Work processes are designed that incorporate knowledge capture and use	1	2	3	4	5	6	7
SF11	Learning Organization	1	2	3	4	5	6	7
SF12	Security/protection of knowledge	1	2	3	4	5	6	7

SECTION TWO

The second objective of this panel is to evaluate the following e-management tools on how each one satisfies the Success Factor Criteria from the above table. At the end of each evaluation, you are requested to write a small explanation about your evaluation.

(SF1) The following systems can efficiently and effectively integrate technical infrastructure including networks, databases/repositories, computers, software, and KMS experts.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF2) The following systems can efficiently and effectively support a knowledge strategy that identifies users, sources, processes, storage strategy, knowledge and links to knowledge for the KMS.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF3) The following systems can efficiently and effectively support a common enterprise wide knowledge structure that is clearly articulated and easily understood.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF4) The following systems can efficiently and effectively support Motivation and Commitment of users, including incentives and training.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF5) The following systems can efficiently and effectively support an organizational culture that supports learning and the sharing and use of knowledge.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF6) The implementation of the following systems can be done without Senior Management support, including allocation of resources, leadership, and providing training.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF7) The following systems can efficiently and effectively embody measures to assess the impacts of the KMS and the use of knowledge as well as verifying that the right knowledge is being captured.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF8) There is a clear goal and purpose for each of the following KMS.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF9) The search, retrieval, and visualization functions of each of the following KMS support easy knowledge use.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF10) Work processes are designed that incorporate knowledge capture and use.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF11) The following systems can efficiently and effectively support the concept of a Learning Organization.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

(SF12) The implementation of the following systems can provide the adequate security and protection of knowledge.

	Strongly disagree	Disagree	Somewhat disagree	Neither agree nor disagree	Somewhat agree	Agree	Strongly agree
Adobe Director	1	2	3	4	5	6	7
MetaCard	1	2	3	4	5	6	7
i-Think	1	2	3	4	5	6	7
PowerSim	1	2	3	4	5	6	7

Comments

APPENDIX D: DELPHI QUESTIONNAIRE ROUND TWO

DELPHI QUESTIONNAIRE CONCERNING THE EVALUATION OF
e-MANAGEMENT'S TOOLS ON HOW THEY CAN SUPPORT TRAINING
AMONG GEOGRAPHICALLY DISPERSED MILITARY UNITS

Your Name: ____

ROUND TWO

1. In this second round you will begin to interact with the other experts through analysis of summary statistics and the comments they have done during their evaluation phase.

2. In this round you are asked to reassess your position on items presented in round one in light of the others' evaluation and their comments.

3. The primary statistic used to indicate the tendency of the panel is the mean. The mean is the value derived by adding all the values and dividing by the number of the values. Because the main purpose of a Delphi panel is developing a consensus among its members, you will be asked to comment on any different opinion you may have with others' opinion.

SECTION ONE

The first objective of the panel is to define the relative importance of each of the twelve criteria which will be used as success factors in our evaluation.

Using the scale below, indicate how important or relevant each of these factors is in an efficient and effective flow of knowledge.

Most ---→ Very
Unimportant Important

1 2 3 4 5 6 7

ID	Success Factor	Rank	Mean		
SF1	Integrated Technical Infrastructure including networks, databases/repositories, computers, software, and KMS experts	4	6.0	----	----
SF2	A Knowledge Strategy that identifies users, sources, processes, storage strategy, knowledge and links to knowledge for the KMS	8	5.7	----	----
SF3	A common enterprise wide knowledge structure that is clearly articulated and easily understood	4	6.0	----	----
SF4	Motivation and Commitment of users, including incentives and training	4	6.0	----	----
SF5	An organizational culture that supports learning and the sharing and use of knowledge	3	6.2	----	----
SF6	Senior Management support including allocation of resources, leadership, and providing training	2	6.3	----	----
SF7	Measures are established to assess the impacts of the KMS and the use of knowledge as well as verifying that the right knowledge is being captured	7	5.8	----	----
SF8	There is a clear goal and purpose for the KMS	1	6.5	----	----

SF9	The search, retrieval, and visualization functions of the KMS support easy knowledge use	12	5.0	----	----
SF10	Work processes are designed that incorporate knowledge capture and use	11	5.2	----	----
SF11	Learning Organization	8	5.7	----	----
SF12	Security/protection of knowledge	10	5.5	----	----

SECTION TWO

The second objective of this panel is to evaluate the following e-management tools on how each one satisfies the Success Factor Criteria from the above table. At the end of each evaluation, you are requested to write a small explanation if your evaluation is +1, -1 from the mean consensus of the panel.

Using the scale below, indicate in what level Adobe Director can satisfy each of the below Success Factors.

Strongly Disagree --Strongly Agree

1 2 3 4 5 6 7

Success Factor	Rank	Mean	Round 1	Round 2
SF1	7	5.8		
SF2	10	5.5		
SF3	7	5.8		
SF4	5	6.3		
SF5	2	6.5		
SF6	5	6.3		
SF7	11	4.8		
SF8	2	6.5		
SF9	1	6.7		
SF10	9	5.7		
SF11	2	6.5		
SF12	12	3.2		

Using the scale below, indicate in what level Metacard can satisfy each of the below Success Factors.

Strongly Disagree --Strongly Agree

1 2 3 4 5 6 7

Success Factor	Rank	Mean	Round 1	Round 2
SF1	1	6.5		
SF2	8	5.5		
SF3	4	6.0		
SF4	8	5.5		
SF5	2	6.2		
SF6	5	5.8		
SF7	11	5.0		
SF8	2	6.2		
SF9	5	5.8		
SF10	10	5.3		
SF11	5	5.8		
SF12	12	3.5		

Using the scale below, indicate in what level i-Think can satisfy each of the below Success Factors.

Strongly Disagree --Strongly Agree

1 2 3 4 5 6 7

Success Factor	Rank	Mean	Round 1	Round 2
SF1	3	6.0		
SF2	3	6.0		
SF3	8	5.8		
SF4	3	6.0		
SF5	8	5.8		
SF6	11	5.7		
SF7	1	6.2		
SF8	1	6.2		
SF9	8	5.8		
SF10	3	6.0		
SF11	3	6.0		
SF12	12	3.7		

Using the scale below, indicate in what level Powersim can satisfy each of the below Success Factors.

Strongly Disagree --Strongly Agree

1 2 3 4 5 6 7

Success Factor	Rank	Mean	Round 1	Round 2
SF1	3	6.0		
SF2	3	6.0		
SF3	8	5.8		
SF4	3	6.0		
SF5	8	5.8		

SF6	11	5.7		
SF7	1	6.2		
SF8	1	6.2		
SF9	8	5.8		
SF10	3	6.0		
SF11	3	6.0		
SF12	12	3.7		

Use the space below for any comments or proposal

SECTION THREE

The results from round one show that the e-management tools have in some cases complementary effects (e.g., they dominate in specific success factors while the others dominate the rest). Below is the table which shows the ranking of each system in each of the success factors. For example the Metacard has a better evaluation in success factor 1 while the Adobe Director has the best evaluation in success factor 9.

	Adobe	Metacard	i-Think	Powersim
SF1	7	1	3	3
SF2	10	8	3	3
SF3	7	4	8	8
SF4	5	8	3	3
SF5	2	2	8	8
SF6	5	5	11	11
SF7	11	11	1	1
SF8	2	2	1	1
SF9	1	5	8	8
SF10	9	10	3	3
SF11	2	5	3	3
SF12	12	12	12	12

Please indicate your preference couple if two systems could be implemented simultaneously to support the flow of tacit knowledge, through training, among geographically dispersed organizations.

Please choose one.

System 1	**System 2**	Place a √ in your choice
Director	Metacard	
Director	PowerSim	
Director	i-Think	
Metacard	PowerSim	
Metacard	i-Think	
PowerSim	i-Think	

APPENDIX E: DELPHI QUESTIONNAIRE ROUND THREE

DELPHI QUESTIONNAIRE CONCERNING THE EVALUATION OF
e-MANAGEMENT'S TOOLS ON HOW THEY CAN SUPPORT TRAINING
AMONG GEOGRAPHICALLY DISPERSED MILITARY UNITS

Your Name: ____

ROUND THREE

1. In this third and final round you are asked again to reassess your position on items presented in round one in light of the others evaluation and their comments.

3. The primary statistic used to indicate the tendency of the panel is the mean. The mean is the value derived by adding all the values and dividing by the number of the values. Because the main purpose of a Delphi panel is developing a consensus among its members, you will be asked to comment on any different opinion you may have with others' opinion.

SECTION ONE

The first objective of the panel is to define the relative importance of each of the twelve criteria which will be used as success factors in our evaluation.

Using the scale below, indicate how important or relevant each of these factors is in an efficient and effective flow of knowledge.

Most Unimportant --→ Very Important

1 2 3 4 5 6 7

ID	Success Factor	Rank	Mean	Round 2	Round 3
SF1	Integrated Technical Infrastructure including networks, databases/repositories, computers, software, and KMS experts	4	6.0	----	----
SF2	A Knowledge Strategy that identifies users, sources, processes, storage strategy, knowledge and links to knowledge for the KMS	8	5.7	----	----
SF3	A common enterprise wide knowledge structure that is clearly articulated and easily understood	4	6.2	----	----
SF4	Motivation and Commitment of users, including incentives and training	4	6.0	----	----
SF5	An organizational culture that supports learning and the sharing and use of knowledge	3	6.5	----	----
SF6	Senior Management support including allocation of resources, leadership, and providing training	2	6.3	----	----
SF7	Measures are established to assess the impacts of the KMS and the use of knowledge as well as verifying that the right knowledge is being captured	7	5.7	----	----

SF8	There is a clear goal and purpose for the KMS	1	6.7	----	----
SF9	The search, retrieval, and visualization functions of the KMS support easy knowledge use	12	5.2	----	----
SF10	Work processes are designed that incorporate knowledge capture and use	11	4.8	----	----
SF11	Learning Organization	8	5.8	----	----
SF12	Security/protection of knowledge	10	5.5	----	----

Expert 2: He believes that the importance of SF5 and SF6 is not so significant after the system had been created and started working. They are very important for the very beginning only).

Expert 2: He believes that SF12 is very important in order not to allow use of their knowledge against the “creator” or “user”.

Expert 3: He believes that SF7 should be evaluated low because it is difficult to find specific reliable measures to assess the impact of the KMS.

Expert 3: He believes that SF12 is not so important if we believe the “Open Systems”.

SECTION TWO

The second objective of this panel is to evaluate the following e-management tools on how each one satisfies the Success Factor Criteria from the above table. At the end of each evaluation, you are requested to write a small explanation if your evaluation is +1, -1 from the mean consensus of the panel.

Using the scale below, indicate in what level Adobe Director can satisfy each of the below Success Factors.

Strongly Disagree --Strongly Agree

1 2 3 4 5 6 7

Success Factor	Rank	Mean	Round 2	Round 3
SF1	7	5.8		
SF2	10	5.3		
SF3	7	5.8		
SF4	5	6.3		
SF5	2	6.5		
SF6	5	6.3		
SF7	11	4.8		
SF8	2	6.5		
SF9	1	6.7		
SF10	9	5.7		
SF11	2	6.5		
SF12	12	3.2		

Using the scale below, indicate in what level Metacard can satisfy each of the below Success Factors.

Strongly --Strongly
Disagree Agree

1 2 3 4 5 6 7

Success Factor	Rank	Mean	Round 2	Round 3
SF1	1	6.3		
SF2	8	5.5		
SF3	4	5.8		
SF4	8	5.5		
SF5	2	6.2		
SF6	5	6.0		
SF7	11	5.0		
SF8	2	6.2		
SF9	5	5.8		
SF10	10	5.2		
SF11	5	5.8		
SF12	12	3.2		

Using the scale below, indicate in what level i-Think can satisfy each of the below Success Factors.

Strongly --Strongly
Disagree Agree

1 2 3 4 5 6 7

Success Factor	Rank	Mean	Round 2	Round 3
SF1	3	6.0		
SF2	3	6.0		
SF3	8	6.0		
SF4	3	6.0		
SF5	8	5.8		
SF6	11	5.8		
SF7	1	6.2		
SF8	1	6.2		
SF9	8	5.8		
SF10	3	6.0		
SF11	3	6.0		
SF12	12	3.3		

Using the scale below, indicate in what level Powersim can satisfy each of the below Success Factors.

Strongly Disagree --Strongly Agree

1 2 3 4 5 6 7

Success Factor	Rank	Mean	Round 2	Round 3
SF1	3	6.0		
SF2	3	6.0		
SF3	8	5.8		
SF4	3	6.0		
SF5	8	5.8		

SF6	11	5.7		
SF7	1	6.2		
SF8	1	6.0		
SF9	8	5.7		
SF10	3	6.0		
SF11	3	5.8		
SF12	12	3.3		

Use the space below for any comments proposal.

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